The Meteorology of Egypt and its Influence on Disease

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THE WINTER

METEOROLOGY OF EGYPT

AND ITS

INFLUENCE ON DISEASE

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THE

WINTER CLIMATE OF EGYPT

(*Read before the Royal Meteorological Society of England, December* 16, 1896)

PREFACE

THE original research upon which this work is based was undertaken by the Author some four or five years ago, and has lasted to the present time. The numerous questions that were constantly asked by doctors and invalids as to the differences in climatic conditions at the different health stations of Egypt, and as to what conditions might be expected at a given station in a given month, suggested to the Author that possibly a comparative view of the whole of Egypt climatically could be obtained by means of a series of automatically recording instruments working under precisely comparable conditions at the various stations. Through the kindness of several friends, both medical and lay, to whom the Author has expressed his thanks in both papers, it has been possible to gather together from the different latitudes of Egypt, where it is possible for invalids to reside, a very large series of records. Covering, as these records do, the whole day and night without intermission, for three or four winters, they have afforded ample material for solving several interesting questions, such as the course pursued by the temperature and relative humidity at all hours of the night; the effect of cultivation on the temperature; the effect cultivation would have in upsetting the conclusions drawn from a comparative consideration of the climate of two places, not equally influenced by it, unless due allowance was made for this factor; the change at sunset; the effect of desert and of altitude on the day and night temperature, and on the humidity; all questions of considerable interest which have not been examined comparatively previously.

It is hoped that the second part of this treatise, embodying most that is of medical interest in the first part, may be of service to those of the medical profession who are not able to visit this country themselves and yet may wish to be acquainted with the therapeutic influence of a climate, which in several respects is unique.

To those who have been ordered to winter in Egypt, and to those interested in its climatology, this work may serve as a guide to what different climatic conditions may be expected at the different Health Resorts in a country where the variation is so small from year to year. Temperatures are given on the Fahrenheit scale. A table (Table XI.) on page 49 gives the comparative readings on the Fahrenheit and Centigrade scales.

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THE WINTER CLIMATE OF EGYPT

Up to the present time such observations as have been made on the climate of Egypt, as far as they have been consecutively taken, have been generally limited to Alexandria and Cairo. No definite knowledge has been obtained of the conditions present in the Nile valley. As regards the desert, from the nature of its inhospitable surroundings, our sources of information are limited to the notes and observations of various scientific expeditions that have traversed the Sahara to and from the Nile valley, and these, being taken in transit, naturally are not continuous for any spot for any long period. Observations at Luxor or some other point in the Nile valley, south of Cairo, have been taken by men residing for a short time, such as those by Mr. Maclean, M.B., B.S., at Luxor in 1868,—very excellent in themselves, yet not arranged to be synchronous and comparable with observations at other stations, and, therefore, of limited value. The remaining observations available are those of travellers on the Nile itself, generally in dahabeahs and under constantly varying conditions.

The present series of observations was undertaken three years ago, with the kind assistance of several friends at other stations in Egypt, provided with similar instruments, and working on the same method at comparable sites, in order to arrive at a knowledge of the climate of Egypt generally, and of the Nile valley specially, during the winter. Such information was specially needed by those of us resident as physicians in the country, and by the medical profession generally. In this paper, however, the medical aspects of the climate, interesting though they would be, will not be discussed.

General Climatic Conditions.

Although this paper will be limited to the winter conditions chiefly, reference will occasionally be made to the conditions present at other times of the year. Egypt, like other countries, depends for its climate upon its surroundings; the geographical, geological, and topographical conditions of these surroundings will largely influence such factors of its climate as the temperature, humidity, and the presence of air-borne particles, organic or inorganic. The consideration of the surroundings is especially important, in the case of Egypt, if we are to attempt to understand its climate.

Egypt, as we shall consider it in this paper, is nothing else but that portion of the Sahara, only eight or ten miles broad for nine-tenths of its

length, which the Nile has been able to cover for countless years with its annual deposit of mud from Abyssinia and Equatoria, and through which it still flows, the only river of the Sahara capable of resisting the sun's power. We look on Egypt as that narrow road across the Sahara desert to the Soudan, where one's caravan could constantly obtain water and, for the most part, pasturage. To take a similar direction only a few miles east or west would be to travel through frightful solitudes, through deserts of fascinating loneliness, of boundless wastes of rising and falling ground; here, low rounded disintegrating sandstone hills, with overhanging edges on one side, and in the gorge between this and the next the drift-sand, which, driven by the wind for countless ages, has helped the sun in the process of disintegration; there, long stretches of undulating plains of limestone scattered with broken portions split off by the enormous variations of heat and cold; here again, the long succession of sand-dunes stretching away for hundreds of miles, often rising to the height of 300 feet, and curiously found to have been heaped up, grain by grain, by the prevailing winds, thus forming a gigantic indicator and record of their direction, and resembling a golden sea struck suddenly silent and still. Above is the deepest blue, cloudless firmament, the sun rising and setting like a brazen mass in a violet sky, the air invigorating and fresh as it is hot, yet with no trace of human or other life, vegetable, animal, or even germ. Day after day to cease to advance day or night, for hundreds upon hundreds of miles, is death, in a climate unequalled elsewhere; yet at what a cost has this been effected.

The Punjab, Mesopotamia, and other countries are hotter in the summer than the centre of the Libyan desert, and they flourish under an equally powerful sun. The soil of the Sahara only needs occasional rain and the desert would spring into verdure instantly, but its climate can give it little or no moisture, as it often affords only the softly shimmering miraged lake with its feathery palms.

Neither the sun nor the soil is the cause of the desert, but the climate alone. Standing on either bank on the cliffs that overhang the Nile valley and form the escarpment of the Sahara plateau, which, for the most part, is over 500 feet higher than the mean of all Europe,[1] we look out on the desert, the gift of the climate, and below us we see Egypt, the gift of the Nile.

In a country where the possible evaporation far surpasses the rainfall, there must be progressive dryness going on. Such rivers as did exist in the Sahara run only a short distance now, or appear as a string of shallow lagoons, united from time to time by a small stream; the Nile alone reaches the other side. Lakes once filled with fresh water, now by successive evaporations, are reduced to brine, their edges sparkling with salt ridges, like foam.[2] In parts of the Sahara, as in Tunis, masses of brine and sand have rendered a crust possible over a syrupy lagoon, where a caravan can disappear, camels and all, and leave no trace.[3]

Winds have been called "the vehicles of the climate," and we shall see later the large influence the winds of the Libyan desert have over the climate of Egypt; we must, however, first refer to the probable causes of the direction taken by these winds:—

[1] M. Chavanne, *Afrika im Lichte unsrer Tage*. Vienna, 1881.
[2] Rohlfs, *Kufra*. [3] *Journal Asiatique*, 1852. Voyage dans la Régence de Tunis.

(1) The *barometric pressure.* This Hann has pointed out increases during winter from the sea towards the interior, at least as far as Cairo and Assiout, and probably into the Libyan desert.

(2) The *lower temperature of the Libyan desert in winter.* At the great sand-dunes (lat. 25°) the temperature was 7° colder than at Cairo[1]; at Farafrah (lat. 27° 2′), 5°-9°; at Dakhel (lat. 25° 42′), opposite Luxor, 2°; which, with the difference between Cairo and Alexandria, gives a difference of about 6° between the desert and the Mediterranean. These facts point to the presence of a region of high pressure in the north of the Libyan desert and south of Tripoli, as Hann has pointed out, and characterised by calms and variable winds, as at Mourzouk. From the neighbourhood of this area the winds of winter escape as a South-west wind to the north, North-west to the east, North-east to the south, and South-east to the west. Thus at Alexandria the South-west wind predominates, at Cairo South-west and North-west equally; in Tripoli, West and South-west; in the south of Libyan desert, Upper Egypt and Nubia, North-west. In the central desert and Upper Egypt there is a large proportion of calms. In summer, as has been shown by M. Schirmer,[2] from the records of Rohlfs, Duveyrier, Nachtigal, and Cailliaud, the reverse takes place, the Sahara is hotter than the sea, the pressure is lower towards the Sahara centre than the sea, and the area extends farther south than that of the winter. The continent draws in the winds on three sides to the centre, the Etesian winds of Herodotus in the north, the South-west rainy winds in the West Soudan, and the South-east winds on the Upper Nile.

Libyan Climate.

Having referred generally to the winds which bring Egypt its climate, we shall now glance at the characteristics of this Libyan climate. First, the humidity, for, in proportion to its amount, considered relatively, so will be the vast natural effects produced. As is well known, the reduction of a few inches in the rainfall annually will produce a *steppe*, and a further reduction a desert; so between the Soudan and Sahara is a tract of country with limits varying from year to year, presenting these changes. From the south of the Sahara one passes from the desert, absolutely sterile, through islands of *mimosa*, dotted in seas of sand, into the verdant Soudan, and thence into the virgin forests of equatorial Africa. A year or two later, the intervening country may be a desert, the northern limit of the South-west rainy winds in summer having been pushed one way or the other with equally favourable or disastrous results. In the centre of the Libyan desert in winter, the air is found to be dry, and it remains so owing to the movement of descent compensating the escape of air in all directions from the centre. This colder upper air, not sufficiently moist to cause rain, now descends and passes from this Libyan desert centre towards the centres of lower barometric pressure, and in doing so is heated by the desert surface, and rendered drier still. A shower condensed in the upper regions over the desert has often been seen to be dissipated before reaching the earth, but at Luxor on March 15, 1895, during a strong South-west Khamseen wind, drops of rain were felt, when the relative humidity was only 40 per cent. On another occasion at 6 p.m., under similar conditions, spots

[1] Rohlfs, 1873-74.

[2] *Sahara.* Paris, 1893.

of rain were falling, though the dry and wet bulb thermometers showed a difference of 20°. In summer the winds are reversed, coming into the Sahara from the sea on all sides, so that even at the centre there is found to be a large quantity of vapour, even more than could be contained in the air of London at any time. The advance being on all sides, the relatively drier North wind from the Mediterranean prevents the advance of the rainy South-west wind, and thus limits the encroachment of the Soudan on the desert; were it not for the Mediterranean conditions would change. The relative humidity may be extremely low, as Rohlfs found in April 1880, for five days, from 10 a.m. to 4 p.m., 3 to 8 per cent only, in the valley of Igharghareu. The mean relative humidity of the Libyan desert in winter is 50 per cent (Jordan 1873-74); at Djofra, 41 per cent, in February 1879 (Rohlfs); of Biskra, 62 per cent from December to February (for ten years, 1879-89). The mean of the Sahara is about 46 per cent in winter (Schirmer).

The moisture remains invisible generally, the cloudless sky being of a remarkably deep blue, or even indigo colour, whereas at Cairo and occasionally in the Nile valley, the sky is often of a very pale blue.

The air has therefore a remarkable purity and clearness, producing a high power of diathermancy. At night the wind has fallen, any trace of cloud is gone, the clearness and stillness are unsurpassed, and dew is rarely observed, even should the freezing-point be reached. In the Libyan desert Rohlfs noted dew six times in seven months; mist was never seen. Rain, rare in the Sahara, is rarer still in the Libyan desert area, yet in 1874 the Rohlfs mission met with a deluge lasting three days, preceded by a violent tempest, the wind passing from South-west to North-west.

That the small amount of moisture in the form of rain or dew in the Libyan desert has been a condition present for all historic time, and probably far back into geological time is evidenced by: (1) The perfect preservation of sun-dried brick buildings of the Roman period in the Libyan desert, and of others dating back to 6000 years in Egypt, which would have been washed away rapidly in England; (2) The absence in the Libyan desert of marked erosion, which is common in other parts of the Sahara. Such erosions as do occur are largely due to the other causes of this condition, such as dissolved carbonic acid (*sic*) destroying the cements, temperature changes varying from 23° to 160°, and wind, the last factor, which has made the Libyan desert a sea of moving sand-dunes often 300 feet high, and even reaching 900 feet in height, and resting not on a base of quartz, but one of limestone; (3) The changes which long ages have been able to effect in the flora and fauna, evolving forms specially adapted to the dryness of the surroundings. The great heat and dryness has excluded the flora of the Mediterranean, and the coldness of the nights, a tropical vegetation. The existing vegetation is adapted to spring to life, flower, and fruit, in a very short time after a shower of rain, the leaves either falling off with the dryness, or replaced by spines impermeable to the drying effects of the air, or else they are very small, as in the tamarisk and the gum-acacia. The leaves may take a vertical position parallel to the sun's rays, or else the branches approach each other for a protection from the heat. The leaves, covered with bad conductors of heat, are folded, or secrete a volatile oil, internally; they may be filled

with a mucilage tenacious of moisture, or the stomata may be closed at times with gum; sometimes the sap is saline. On rocks in the desert, absolutely without water, plants exist, so that Rohlfs believed they must obtain water from the air, and plants, such as the *Reaumuria hirtella*, have been seen covered with minute drops of water, which have been replaced at sunrise by minute crystals of salt produced by the plant, when no dew was deposited elsewhere, thus actually obtaining moisture from the air itself.[1] As regards the fauna, almost all desert animals can go for long periods without water, the camel on herbage alone will go for a month, and Rohlfs' camels took no water for eighteen days.

The temperature in the Libyan desert, which we have seen largely influences the amount of humidity in the air of Egypt, is colder than Cairo. The wind from the West and South-west in the months of January and February may be very cold, although in March and April it becomes a very hot wind, especially if more from the South. The daily variation of temperature in the Libyan desert was 35° (May 1879).[2] At Mourzouk 28° (from November to March 1865-6),[3] and 68° has been observed in Tripoli, the minimum being 31° (December 25, 1879),[4] and 58° at Toro near Borkou (May 15, 1871).[5]

Captain Lyons, R.E., in the Nubian desert near Murat Wells, gives me for December 10, 11, 12, 1894, a variation of only 17°. The Medical Department of the Egyptian War Office have kindly furnished me with the temperatures at Korosko and Khargeh, which for November 1894 show a mean daily range of 34° at Korosko, and of 32° at Khargeh.

The annual variation, or difference of the means of the coldest and warmest months in the Libyan desert is as much as 29°, at Koufra the mean of January 1879 being 56°, and that of August 85°.[6] As an absolute minimum temperature 23° was noted in the Libyan desert in 1874,[7] and water often freezes at night. As an absolute maximum 122° in the shade may be taken as authentic,[8] giving a variation for the year of at least 90°.

Climate of Nile Valley.

Having referred briefly to the climate of the Libyan desert, we shall now discuss the conditions present in that part of the desert through which the Nile flows.

Egypt consists of the broad Delta and the narrow Nile valley, and is everywhere flat. From the base of the Delta to Cairo, at the apex, is about 130 miles, thence the Nile valley extends to the south in a direction north and south to Assiout, then south-east to Guerga, then due east to Kench, then south again. The valley is bordered on either side by a low range of flat-topped cliffs of nearly uniform height, the plateau above extending away at varying levels in undulating desert. The river follows the winding curves marked out by the cliffs, as a rule nearer the eastern than the western cliffs; but at Luxor and Assouan the river

[1] Volkens, *Die Flora der Aegyptisch-Arabischen Wüste.* Berlin, 1887.
[2] Rohlfs, *Kufra.*
[3] Rohlfs, *Reise durch Nord-Afrika.*
[4] Rohlfs and Stecker, *Kufra.*
[5] Nachtigal, *Sahara und Sudan.* Leipzig, 1879.
[6] Rohlfs, *Kufra.*
[7] Jordan, *Physische Geographie der Libyschen Wüste.* Cassel, 1876.
[8] At Soûf, "Escard, Étude médicale sur l'oued-Soûf," *Arch. med. mil.* 1886.

approaches the western cliffs. The cliffs average 300 feet in height, though at Thebes they reach four times that height. Between the hills the cultivated Nile valley occupies about two-thirds of the extent, the remainder is desert. The mean breadth of the Nile is one-half to three-quarters of a mile, varying with the time after the flood.

The Nile commences to rise about the last week of July, rises rapidly till the middle of August, and the remaining third of the rise takes another month or six weeks until the end of September. During October, Upper Egypt, as far north as Cairo, is under water, the basins being filled from the Nile. In the Delta the canals are full, but the water on the surface is less in amount than in Upper Egypt. About the second or third week of November, the Nile has fallen one-third of its usual rise, and two-thirds by the end of December. The rise is 40 feet at the first cataract, 36 feet at Luxor, 25 feet at Cairo, and 4 feet at Rosetta and Damietta.

The climate of Egypt during the winter is influenced by: (1) The Libyan or Western desert; (2) The Mediterranean Sea; and we shall endeavour to show that there is a third factor, the extent of cultivated land. To obtain some idea of these respective influences, we shall consider the climate of (1) *Alexandria*, under the influence of both sea and desert in the winter months; (2) *Cairo at the apex of the Delta* under the influence of desert to some extent, and also the modifications brought about in the sea-air by the intervention of 130 miles of cultivated land; (3) *Stations near Cairo:* (*a*) Helouan, on the east side of the Nile, 15 miles south of Cairo; (*b*) Mena House, near the Great Pyramid, on the west side of the Nile, and 8 miles from Cairo, on the edge of the desert; (4) *Stations in Upper Egypt:* (*a*) Luxor, with adjacent stations; (*β*) Assouan at the first cataract.

I shall base my remarks on the climate of Alexandria and Cairo on the report for the five years 1886-90, prepared by Dr. Engel Bey for the Egyptian Government, which is a résumé of the observations taken for those years, by Esmatt Effendi, at the Khedivial Observatory at Abassiyeh, situated about a mile and a half in the desert north-east of Cairo, the cultivated land being half a mile distant on the north side. The station was 40 feet above the ground under a kind of covered verandah, and may be considered as intermediate between the actual climate of Cairo, and a place situated in the East desert, some few miles to the south of Cairo. The observations at Alexandria were taken on the roof of a house in the town by M. Pirona for the Central Meteorological Institute of Vienna.[1]

The differences between the two places are very remarkbale, and characteristic as to the daily and seasonable variations. The temperature of Cairo is much higher in the summer and a little lower in the winter than that of Alexandria. The relative humidity varies much more at Cairo, but in the inverse direction, being much lower at Cairo in the summer, and a little higher in the winter than at Alexandria. The absolute humidity is far greater at Alexandria than at Cairo, but descends rapidly in the winter to about the same level. The rain and the force of wind are much greater at Alexandria than at Cairo. The climates of Alexandria and of Cairo with mean annual temperatures (five years) of

[1] *Jahrbücher der K.K. Central Anstalt für Meteorologie, Wien.*

69° and 70°·4 are subtropical, yet the former is characterised as being a maritime, and the latter, although only a small distance from the sea, as a continental climate; both, however, are seen to be under the influence of both desert and sea.

Cairo.

The mean temperature is 70°·4, slightly varying from year to year.

The mean daily variation is 25°.

The mean absolute maximum is 112°, the mean absolute minimum is 36° (for five years). The absolute maximum was 118°, and the absolute minimum 34°.

The temperature descends gradually from the maximum of the 30th week of the year, by even stages, to the minimum in the 4th week of the following year.

The stability of the temperature is very marked in winter and autumn, in the spring rapid changes take place at irregular intervals, the temperature rising suddenly only to fall again, notably at the period of the 50 days ("Khamseen") between the Coptic Easter and Pentecost, characterised by winds of that name from the South and South-west, which are preceded by a barometric depression and bring excessive heat, varying from 100° to 108°, and marked dryness, with fine sand in clouds from the desert, hiding the sun or rendering it a dull yellow colour. A Khamseen lasts from 2 to 4 days, the change following is abrupt, the wind passing to the North-west or West with increased barometric pressure and relative humidity, and a much lower temperature. Occasionally storms occur at this time. The relative humidity is often lowered during a Khamseen to 10 or even to 3 per cent.

The mean daily variation of temperature in winter is about 22°, but during a Khamseen the differences may reach 42°, 47°, and even 51°.

The least daily variations are in winter, owing to the maximum keeping low. It may be only 9°—even 7° has been noted.

The absolute humidity for the year is relatively high, ·425 in.; it is least in the winter.

The relative humidity is 61·2 per cent; it is lowest in June, and then rises till the end of December, slowly falling again, about 6 per cent per month, till the end of March.

At the time of the inundation, the absolute humidity increases, and, the temperature being stationary, the relative humidity is higher.

Alexandria.

The mean temperature is 69°. Maritime conditions give a smaller range to both temperature and relative humidity.

The temperature is lower in summer and higher in winter than at Cairo.

The mean daily variation (five years) is 8° (Cairo 25°). The marked daily variations are, as at Cairo, the most frequent between March and June (the period of Khamseen), but they are more frequent at Cairo in February, and at Alexandria in March.

The mean winter temperature is 60° (Cairo 59°), from December to March; the sea overbalancing in its influence the colder South-west winds

from the desert. This is affected by a lowering of the temperature by day, and an increase in the temperature by night at Alexandria as compared with Cairo, but the difference is more due to a raised minimum than to a depressed maximum, the minimum being raised by three times the amount that the maximum is depressed.

From the middle of February to the first week in November the mean temperature of Alexandria descends below that of Cairo, and in summer the mean maximum of Alexandria is actually below the mean of Cairo; in winter the mean minimum of Alexandria is equal at times to the mean of Cairo.

The absolute humidity increases much more rapidly in the spring than at Cairo, reaching its maximum in July with the temperature. It falls as quickly, the influence of the sea, which had been partly overcome in the winter by the South-west desert winds, being re-established with the prevailing North wind of summer.

The relative humidity, instead of falling in spring as at Cairo, rises slowly to July, then falls gradually below the level of Cairo till the following spring.

In October, with the high Nile, comes a slight increase of temperature, and of relative and absolute humidity; the increase of humidity is also clearly seen at Cairo.

The mean annual atmospheric pressure is :—

At Cairo (100 feet) 29·56 ins.

At Alexandria (40 feet) 29·64 ins.

The pressure is highest in winter, being at Cairo 29·99 ins., and at Alexandria 29·97 ins.

At *Cairo* the mean annual direction of the wind is N. 14°·89 W. From May to October, the direction is almost exclusively North; at the end of October the atmospheric pressure rises over the Libyan desert for the winter, and the South-west winds show themselves occasionally, the Sahara being colder now so that we get a cold Khamseen (South or South-west). In spring the South-west wind is rarer, but comes as a hot Khamseen.

At *Alexandria* the mean annual direction is N. 35° W. The wind blows with far greater force than at Cairo.

Cloud is prevalent to an equal extent at both places.

At *Cairo* there are 17 days of rain a year, nearly all occurring in the winter or spring months. On many of these days only a few drops fall, the mean amount of these days being ·08 in.

At *Alexandria* there are 39 days on which rain is recorded, being more than double that of Cairo, while the amount of rain is 6 or 7 times as great as at Cairo.

Winter Climate.

The series of observations which I shall now bring before you was undertaken by me three years ago, and extends over the winters of 1893-94, 1894-95, and 1895-96, commencing generally in the month of November and extending to the end of March in Upper Egypt, and to April and May at the stations near Cairo. The object was to arrive at a comparative knowledge respecting the climates of the various stations now considered as health resorts in Egypt, and by a strictly comparable

method to arrive at the precise differences between the climates of Upper and Lower Egypt, all previous observations having failed in this respect.

Stations, Instruments, etc.

The stations selected for observation were :—

(1) *Cairo*, 60 feet above the sea, during 1894-95, on a house close to the Hotel Continental, during 1895-96 again on the flat roof of a house and near the Kasr-el-Aini Hospital. There was no cultivated land nearer than one mile, and this was situated on the other (west) side of the river.

(2) *Helouan*, 115 feet above the cultivated land, and 15 miles south from Cairo in the eastern desert. The cultivated land is about 2 miles to the west.

(3) *Mena House Hotel*, 8 miles from Cairo at the apex of the Delta, is 300 yards to the north of the Great Pyramid, in the western desert, and about 20 to 30 feet above the cultivated land, and about 100 yards from the cultivation. On its western side the desert sand-hills rise rapidly to a height of 100 to 150 feet. The edge of the desert, defining the cultivated land, stretches away to the north and then to the north-west.

(4) *Luxor*, 450 miles south of Cairo on the right bank of the river, 241 feet above the sea. The roof of the Luxor Hotel is about 60 yards south-east of Luxor temple, on the south edge of the town. An occasionally watered garden surrounds the hotel. The town with the cultivated land beyond intervenes on the north side between the hotel and the river. The hotel is separated from the river on the west by 100 yards of cultivated land.

(5) *Assouan* on the north side of the first cataract. The Assouan Hotel is on the front of the right bank of the river; immediately opposite the western cliffs come close to the river. There is no cultivated land within 300 yards on the north side of the town. The prevailing wind from North-west or North comes straight up the river to the town.

(6) *Luxor Fields*, a subsidiary station, half a mile south of the town, 5 feet above the ground in the growing corn.

(7) *Luxor Desert West*—subsidiary stations :—

(α) In the *desert portion of the Nile valley* at varying distances from the Nile valley.

(β) On the *south side of the Valley of the Tombs of the Kings*, 2 to 3 miles from the Nile valley and removed from its influence. The position being only 8 feet from the vertical entrance to a royal tomb, hollowed out of the limestone hill rising abruptly on the south side of the valley, was such that the direct sun's rays did not fall on the screen. A reading of the dry bulb in the screen in this position, and one with the screen removed into the vicinity with the sun's rays directly on the screen, gave a difference of $+4^\circ$ in the latter case.

(γ) *The crest of the Libyan Hills.*—This was a point situated 300 to 400 feet above the Nile valley on a promontory jutting out to the east and looking into the Nile valley. The view from this point was unobstructed for three-fourths of a circle, but was blocked to the west, the hills rising still higher.

There was no cliff which could act as a side reflector, except one 30 yards to the west. The position may be considered as "exposed."

In the case of stations (1) to (5), 40 to 50 feet must be added to any elevation given to allow for the mean height of the buildings on which the screens were placed.

All the observations (except those of the subsidiary stations near Luxor) were taken on the flat brown cement roofs of hotels from 40 to 50 feet high. The roof of the Assouan Hotel was of brick. There were no walls which could act as reflectors in the neighbourhood, and comparable sites were selected towards the north on each roof.

The screens containing the instruments were of single louvred sides, partly after the pattern of the Stevenson screen, the portions of the louvred sides sloping downwards and outwards. The roof was single, sloping towards the north and projected slightly. The wood was $\frac{3}{4}$ in. thick in the roof and floor. The screens measured internally 28 inches long, 14 inches deep, and 14 inches high, and stood 5 feet above the roof. The door of the screen opened towards the north in all cases.

The instruments consisted of six sets of self-recording thermometers and hair-hygrometers made by Richard Frères of Paris; all were carefully examined and regulated in one room in Cairo for a week before being placed at their respective stations.

The standard dry and wet bulb thermometers used at each station for regulating the recording instruments were made by Casella of London.

One recording thermometer and one hygrometer were placed in each screen, with the standard thermometers. The dry and wet bulb thermometers were on one "fixture" and more than 4 inches apart, and in taking a reading the "fixture" was placed almost vertically leaning against the outer case of the recording thermometer at the east end of the screen, and looking towards the north. The screen was closed for 10 minutes before the reading was taken.

The possibility of carrying out so extended a series of observations is due to the kindness of several friends resident at the different stations, and I take this opportunity of expressing my thanks to Mr. Longmore, M.R.C.S., and Mr. Jalland, M.B., resident at Assouan; to Dr. Bentley and Mr. J. L. Hichens at Mena House; to Dr. Kaufmann at Cairo; to M. F. Douat at Helouan; and also to Dr. Page May, for kind assistance. The cost of instruments was defrayed by Messrs. Cook, Pagnon, Suarez, and the author.

It was found that any attempt to secure comparable sites, other than those selected on the roofs of buildings, was futile. In discussing the influence of cultivated land, it will be seen that the presence or absence of cultivation in the immediate neighbourhood gives widely different results.

Interpolations.—112 temperature readings out of over 13,000 readings, and 340 relative humidity readings out of over 15,000, have been interpolated; these were calculated on the readings for the corresponding hour for three or four days before and after, regard being paid to any special conditions present on the day itself at other hours, if recorded.

Temperature.

The recording thermometers were found to act remarkably well, rarely, if ever, requiring readjustment.

From the continuous tracings of temperature it has not been possible for three years to give an average for the whole of the four winter months at each of the four principal stations, certain months being found not quite complete.

Tables III.-VII. (pp. 192-194) have been drawn up to show such periods as are comparable at the different stations. The figures for Mena House and Helouan, representing Lower Egypt, will be found to correspond closely owing to their proximity to each other; certain points of difference, however, will be drawn attention to later in discussing the minima. Luxor and Assouan will represent Upper Egypt.

It will be seen (Tables IV.-VII.) that the mean temperature for three years of the four months, December to March, at Mena House (December being only for two years) was 59°·5, at Helouan (two years only) 60°·5, at Luxor 63°·8, at Assouan (January and March two years only) 68°·3. These figures will be seen (Table IV.) to correspond closely with those given for two years only, and also with those (Table III.) given for an entire comparison of four months at the four stations for 1895-6 only. The winter of 1895-6 is seen to be 0°·5 cooler than the mean.

It will be observed from the following Table (A) for the four months

TABLE (A).

Station.	Min.	Max.	Mean.
	°	°	°
Lower Egypt — Mena (Table V.)	48·7	70·4	59·5
Lower Egypt — Helouan (Table IV.)	49·4	71·7	60·5
Upper Egypt — Luxor (Table VI.)	49·6	78·1	63·8
Upper Egypt — Assouan (Table VII.)	54·5	82·1	68·3

December to March that Helouan has a mean temperature 1° warmer than Mena House, Luxor 3°·3 warmer than Helouan, and Assouan 4°·5 warmer than Luxor.

The mean minimum for the same period was 0°·7 warmer at Helouan (two years only) than at Mena House (three years), Luxor (three years) was 0°·2 warmer than Helouan, and Assouan (three years) 4°·9 warmer than Luxor.

The mean maximum for the same period was 1°·3 warmer at Helouan than at Mena House, Luxor was 6°·4 warmer than Helouan, and Assouan 4° warmer than Luxor.

From table (B) we observe that there is a fall of mean temperature in January, which is less marked in Upper than in Lower Egypt, being least at Assouan.

TABLE (B).

Station.	Years.	Jan.	Feb.	March.	April.
		°	°	°	°
Lower Egypt — Mena	1893-94, 1895-96	−4·5	+3·0	+3·1	+5·2
Lower Egypt — Helouan	1894-95, 1895-96	−3·5	+5·4	+2·2	+8·4
Upper Egypt — Luxor	1893-94, 1894-95, 1895-96	−2·7	+3·6	+6·6	...
Upper Egypt — Assouan	1894-95, 1895-96	−1·8	+5·0	+6·5	...

In February the temperature rises less relatively at Mena House and at Luxor than at Helouan and at Assouan; in March there is a further rise which is more than twice as great in Upper as in Lower Egypt. March in Upper Egypt is 8°·6 warmer than December, but in Lower Egypt it is only 2°·8 warmer.

Table (C) shows the progress of the mean maxima from month to month, the additions or subtractions being as in the previous tables to the temperature of the month immediately preceding; we see there is a

TABLE (C).

Station.	Years.	Jan.	Feb.	March.	April.
Lower Egypt { Mena .	1893-94, 1895-96	− 4°·8	+ 4°·5	+ 4°·0	+ 5°·5
Lower Egypt { Helouan .	1894-95, 1895-96	− 3·0	+ 6·4	+ 2·7	+ 9·5
Upper Egypt { Luxor .	1893-94, 1894-95, 1895-96	− 2·1	+ 4·4	+ 7·0	...
Upper Egypt { Assouan .	1894-95, 1895-96	− 1·5	+ 6·7	+ 6·1	...

reduction of the mean maximum in January, which is greater in Lower Egypt than in Upper Egypt, being least at Assouan. In February there is a considerable increase throughout Egypt, though to a less extent at Mena House and Luxor, probably due to the neighbouring cultivation. In March the maximum is still increased, to about twice the extent in Upper Egypt as compared with Lower Egypt. In April in Lower Egypt there is a large increase in the mean maximum corresponding to the large increase in Upper Egypt in March.

Table (D) shows the differences in each month on the previous month in the mean minimum, and it will be observed that the minimum falls in January by about 4°, except at Assouan, where it falls only 2°. In February it rises to about the same extent, but the rise is least at Mena House; in March a further rise takes place $3\frac{1}{2}$ times as great in Upper as in Lower Egypt. In April there is a large rise in Lower Egypt corresponding to that of Upper Egypt in the previous month. It must be noted that the periods selected are not strictly comparable, except in the case of Helouan and Assouan in the three tables (B) (C) and (D).

TABLE (D).

Station.	Years.	Jan.	Feb.	Mar.	April.
Lower Egypt { Mena .	1893-94, 1895-96	− 4°·3	+ 1°·5	+ 2°·2	+ 4°·8
Lower Egypt { Helouan .	1894-95, 1895-96	− 4·0	+ 4·3	+ 1·7	+ 7·3
Upper Egypt { Luxor .	1893-94, 1894-95, 1895-96	− 3·5	+ 3·0	+ 6·2	...
Upper Egypt { Assouan .	1894-95, 1895-96	− 2·0	+ 3·3	+ 6·7	...

If we compare in these tables the total increase of temperature for the first three months of the year with the means of December, we find that as regards the maximum and minimum they have advanced at Mena

House 3°·7 and – 0°·6 respectively, at Helouan 6°·1 and 2°, at Luxor 9°·3, and 5°·7, at Assouan 11°·3 and 8°. In other words, if we take the mean of the advance in Lower Egypt, it is 4°·9 in the maximum and 0°·7 in the minimum; whereas in Upper Egypt the mean of the advance is 10°·3 in the maximum and 6°·8 in the minimum. The rise of the minimum in Lower Egypt is very small, and there is even a retrocession at Mena House; this disproportionate advance of maximum and minimum is less marked in Upper Egypt, especially at Assouan, where the proportion is as stated. If we include the month of April, the advances are at Mena House in the maximum 9°·2, in the minimum 4°·2, and at Helouan 15°·6 and 9°·3. The figures referred to in these tables are of importance in tracing the effect of vegetation upon the course of the temperature, and reference will again be made to them.

In Table VIII. we find the mean differences between the highest and lowest mean daily temperatures in the respective months give for—

December . . .	Lower Egypt,	16°·7	Upper Egypt,	18°·5
January . . .	,,	17°	,,	17°
February . . .	,,	22°·5	,,	20°
March	,,	17°·5	,,	26°·5

The marked variation of the month of March in Upper Egypt is occasioned by the occurrence of the hot Khamseen winds. The maximum variation in the extremes of the daily means of any month was 29°, and occurred at Assouan in February 1896 and March 1894, and also at Luxor in March 1894. The corresponding minimum variation at Mena House in February 1894 was 10°.

The highest mean daily temperature in the three years was 93° at Assouan on March 23, 1896, the lowest 48° at Mena House January 22, 1896. The means of the absolute maximum for the respective months were :—

December . . .	Lower Egypt,	81°·7	Upper Egypt,	88°·3
January	,,	77°·2	,,	87°·3
February . . .	,,	91°·7	,,	97°
March	,,	89°·9	,,	105°

The absolute maximum occurred on March 22, 1894, at Assouan, 109°, being at Luxor 5° lower on the same day. The maximum for the same month at Mena House was on the same day, and was 17° lower than at Assouan.

The means of the absolute minimum for the respective months were :—

December . . .	Lower Egypt,	41°·5	Upper Egypt,	41°·5
January . . .	,,	37°·8	,,	40°·1
February . . .	,,	42°	,,	43°·8
March	,,	44°·4	,,	47°·5

The absolute minimum was 37°, and it occurred at Mena House on January 6, 1895, and on January 21, 1896, at Helouan on January 6, 1895, and at Luxor on January 5, 1895. At Assouan the lowest temperature was 41°.

Lower minima were recorded at the station in the fields near Luxor, which will be referred to later on.

The Range or Mean Daily Variation of Temperature (*Tables IV.-VII.*).

For the four months (December to March) this was found to vary considerably. In Lower Egypt for these months it was 21°·7 at Mena House,

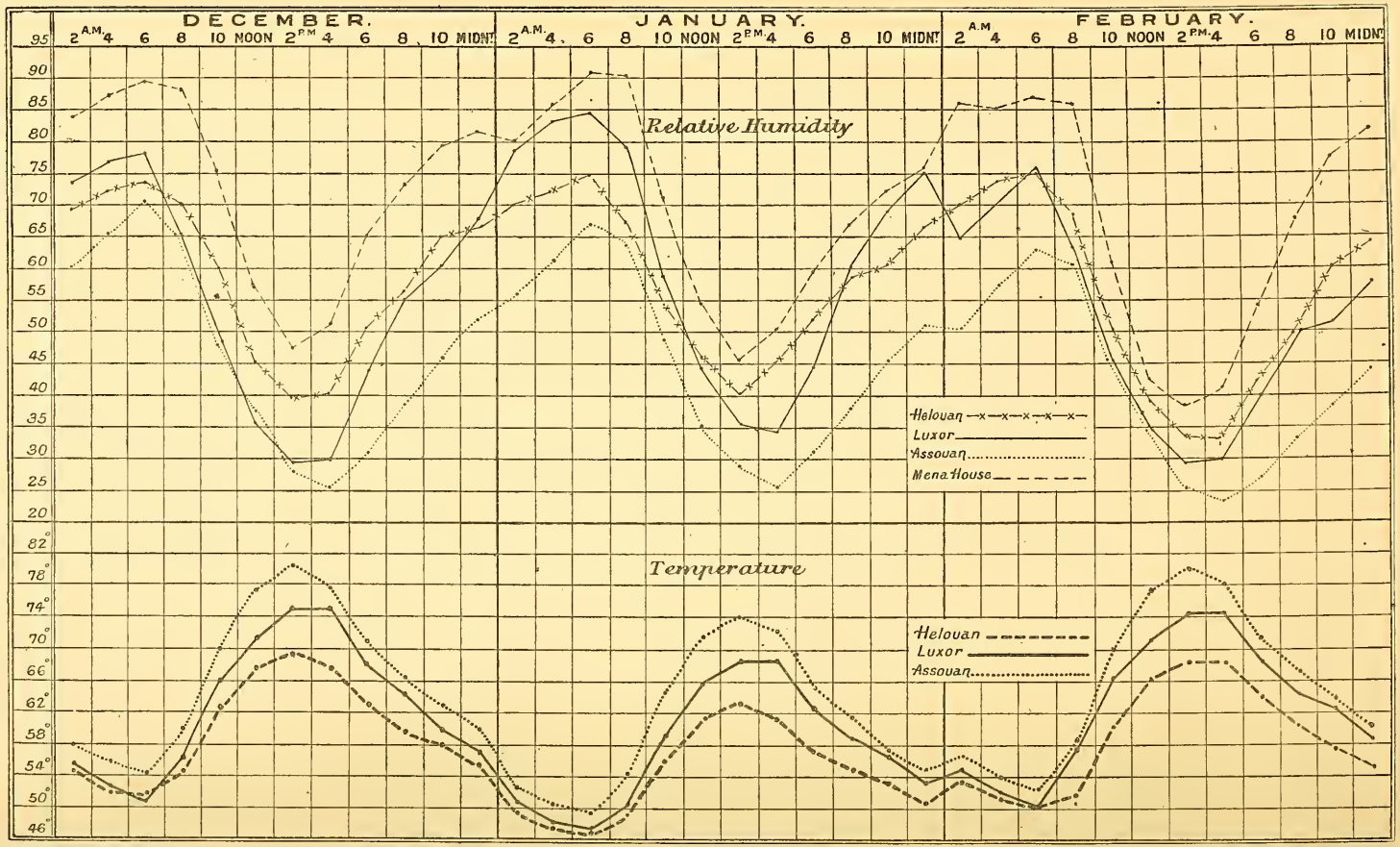

FIG. 1.—Temperature and Relative Humidity at Helouan, Luxor, and Assouan, December 1895 to February 1896.

and 22°·3 at Helouan, being least in December (19°·3), and increasing to April (26°·5) at Helouan.

In Upper Egypt it was greater, being 28°·4 at Luxor and 27°·6 at Assouan, advancing as in Lower Egypt from 25°·6 in December to 30°·1 in March. The greatest mean monthly range was 33°·1 for February 1895 at Luxor, the smallest 18° at Mena House for January 1896.

The absolute monthly range (Table VIII.) was larger in Upper than in Lower Egypt, being in—

December . . .	Lower Egypt,	40°·2	Upper Egypt,	46°·8
January	,,	39°·5	,,	47°·2
February . . .	,,	49°·7	,,	53°·2
March	,,	45°·5	,,	57°·5

The greatest monthly range was 66° in March 1894 at Assouan, and the least, 32°, at Mena House in December 1895. It will be observed that the wide ranges occur in February in Lower Egypt, and in March in Upper Egypt, being caused by the advent of Khamseen winds.

Table II. shows the mean monthly temperature at every two hours at six stations in the winter of 1895-96, the months being complete, except where noted to the contrary. It will be observed that the months of December and January closely approach in temperature at Mena House and Helouan, but in February and March Mena House is certainly colder than Helouan, and it has been seen that this is due in part to a lower maximum and partly to a more depressed minimum. At the hours of 8 and 10 a.m., and at 4 p.m., the difference is decided, and it is caused at 8 and 10 a.m. by the occasional presence of mist over the cultivated land in the neighbourhood of Mena House obstructing the sun's rays. At 4 p.m. the cause is the rapid cooling of the neighbouring fields when the sun passes behind the hills to the west of Mena. It is from 6 p.m. to 6 a.m. in the months of February and March that the great difference in temperature between these two stations is reached, being about 2° in the mean warmer at Helouan than at Mena House. In the previous two months (December and January), for the same hours Mena House was in the mean 0°·5 warmer than Helouan. The height of the crops in February and March in the neighbourhood of Mena House is the agent in reducing the minimum temperature.

The course of the temperature for three months at three of these stations (Helouan, Luxor, and Assouan) is shown in Fig. 1. In this year the mean temperature every two hours for the four winter months varied according to the following Table (E), the figures being the number of degrees to be added to the temperature of the station with which each station is compared.

TABLE (E).—DECEMBER TO MARCH 1895-96.

STATIONS.	2 A.M	4	6	8	10	Noon	2 P.M	4	6	8	10	Midn	Mean.
	°	°	°	°	°	°	°	°	°	°	°	°	°
Helouan compared with Mena	0·5	0·3	0·5	1·4	1·5	1·0	0·9	1·2	0·9	1·0	1·2	1·0	+0·9
Helouan (Jan.-Mch.) compared with Cairo	1·7	1·5	1·4	2·5	2·3	1·0	0·6	1·5	1·3	1·5	2·0	1·8	+1·6
Luxor compared with Helouan	2·1	1·3	0·4	3·8	5·0	5·5	6·6	7·8	5·9	5·1	4·2	3·0	+4·3
Assouan compared with Luxor	2·4	2·9	3·0	3·5	4·8	6·0	5·4	3·3	2·6	1·2	2·4	2·5	+3·3

In the first three months of the year 1896, Cairo (on the roof of a house near the Kasr-el-Aini Hospital with no cultivation near) was 1°·6 colder than Helouan. The difference was, as at Mena House, most marked at 8 and 10 a.m. and at 4 p.m.; and at night Cairo was much colder than either Helouan or Mena House. Mena House, by its position on the edge of the desert, would, on still nights or with a light breeze from the West, be warmer than Cairo, which is more surrounded by cultivation, especially to the west. The course the depression of temperature at night takes at Cairo, lasting up to 10 a.m., corresponds to that due to the influence of cultivation, as seen at Luxor Fields (Table (F)) station, and is also marked at Mena House.

The Table (F) shows the differences of temperature taken every two hours during January and February 1896, and also from March 17 to 23, 1896, the latter period being after, or during, the gathering of the harvest, as compared with the station "Luxor Hotel Roof."

TABLE (F).—"Luxor Fields" compared with "Luxor Hotel Roof."

Time.	2 A.M.	4	6	8	10	Noon.	2 P.M.	4	6	8	10	Midn.	Mean.
	°	°	°	°	°	°	°	°	°	°	°	°	°
Jan. and Feb. 1896	−11·0	−10·5	−10·0	−8·0	−4·0	−2·5	−2·5	−2·5	−6·0	−9·5	−10·5	−9·5	−7·2
March 17-23, 1896	−6·5	−6·0	−3·0	+3·0	+4·0	+4·0	+2·5	+1·0	−5·5	−5·5	−4·5	−7·5	−2·0

"Luxor Fields" station was half a mile south of the hotel, and half a mile east of the river, standing 5 feet above the ground and in the growing corn; the surrounding country was fully cultivated, and no house was nearer than 500 yards; no irrigation of the land took place in the immediate neighbourhood. On January 1 the corn was 10 inches high, 10 to 15 yards to the north was a patch of beans 2½ feet high. The instruments in the cornfield and on the hotel were standardised daily. Mr. Chapman, of the Public Works Department, estimated that at the commencement of January the Nile was 6 yards below the bank, and the Nile water would be met 5 yards below the soil at the "Luxor Fields" station, at 4 yards the soil would be thoroughly soaked, and would be damp the rest of the way to the surface, with the exception of the upper six inches which were dry and broken up. On March 2 the corn was up to the legs supporting the screen. The differences in the Table (F) were + or − those recorded on Luxor Hotel Roof.

This Table (F) is important to demonstrate the very large influence of local conditions, especially in cultivated areas, in modifying the temperature. It must be noted that these wide differences are in the mean, wider differences occurring occasionally. The stations were half a mile apart only. The differences were greater by night than by day, being greatest at 2 a.m. during the period of cultivation, and at midnight during the harvest period. In the cultivated period from noon to 4 p.m. the fields are only 2°·5 cooler than the roof, but after sunset at 6 p.m. 6° cooler. During, or after the harvest, a great change takes place from soon after sunrise till sunset, the dry uncultivated fields are considerably warmer than the roof, reaching 4° difference between 10 a.m. and noon. After sunset to 6 p.m. there is the same difference as before, thence

to 4 a.m. the difference is only half that during the crop time, and at 6 a.m. only one-third. At 8 a.m. the greatest change has taken place, the fields which were during cultivation 8° cooler than the roof, are now 3° warmer.

Thus we see that the growing crops depress greatly the whole night temperature, and therefore the minimum, and this depression lasts till 10 a.m.; they also depress the maximum, though to a much less extent ($\frac{1}{5}$).

During the cultivated period the mean temperature was 7°·2 less, and during or after harvest only 2° less than on the roof.

The range of temperature in the cultivated fields was 32° for January compared with 24°·5 on Luxor Roof; 36° in February compared with 26°·5 on Luxor Roof. The greatest daily variation was 50° on February 24 and 28, 1896, this was the greatest recorded in Egypt in the three winters. The least was 13° on January 17 and 18, 1896. The monthly mean temperature was 6° cooler in January and 7° in February than Luxor Roof.

The mean minimum temperature in January was 36°, or 9°·5 cooler than the mean minimum of Luxor Roof, and in February 37°·5, or 11°·5 cooler.

The absolute minimum was 29° on January 11 and 12, 1896; 30° was recorded on February 4 and 17, being the lowest temperature recorded in Egypt in this series of observations. The freezing-point was reached ten times in January and seven times in February.

The mean maximum temperature was 68° in January and 74° in February, both being 2° lower than the corresponding temperature of Luxor Roof.

TABLE (G).

1894.	Roof.				Northern Verandah.				South Garden.			
	Max.	Min.	Mean	Range	Max.	Min.	Mean	Range	Max.	Min.	Mean	Range
	°	°	°	°	°	°	°	°	°	°	°	°
March 27	83	58	70·5	25	78	61	69·5	17	78	53	65·5	25
,, 31	80	51	65·5	29	73	53	63·0	20	72	48	60·0	24
April 1	89	54	71·5	35	79	56	67·5	23	81	50	65·5	31
,, 2	93	60	76·5	33	81	61	71·0	20	86	55	70·5	31
,, 3	104	63	83·5	41	91	60	75·5	31	95	59	77·0	36
,, 4	102	66	84·0	36	91	67	79·0	24	96	61	78·5	35
,, 5	88	72	80·0	16	84	73	78·5	11	83	68	75·5	15
Means	91·3	60·6	75·9	30·7	82·4	61·6	72·0	20·8	84·4	56·3	70·3	28·1
Difference compared with Luxor Roof.	–	–	–	–	– 8·9	+ 1·0	– 3·9	– 9·9	– 6·9	– 4·3	– 5·6	– 2·6

To indicate the difficulty in obtaining comparable sites in Egypt, Table (G) is given showing simultaneous observations taken at Luxor Hotel on March 27 and 31, and April 1 to 5, 1894:—(1) On the *Luxor Roof;* (2) under the *northern verandah* of the same building, the verandah being a thick mud-brick construction, 50 feet long, 8 feet wide, and 14 feet high, supported by arches and pillars, and obstructing the direct sun's rays at all hours. Beyond the asphalt floor under this verandah was a bed of grass 10 or 12 feet broad frequently watered, and beyond this again other beds occasionally watered, and sand-walks;

(3) *Luxor garden*, this position was on a sand-walk 4 feet broad, about the middle of the garden on the south side of the hotel, and 40 paces from the hotel. The palm trees above threw a broken shade on the Stevenson screen. Less than half the garden consisted of sand-walks, and the remainder of beds for flowers, irrigated by flooding on March 31 only. During the remainder of the time of observation, the surface was dry or drying.

The deep shadow of the north verandah, and the partial shadow of the trees, together with the absence of reflected heat from the cement roof, account for the differences of the maxima. The minimum is depressed about $\frac{1}{2}$ or $\frac{2}{3}$ of the extent which might have been expected in the fields at this time. The mean temperature in the south garden was 5°·5 cooler than on the roof.

Comparative observations were taken, for certain periods, in the desert on the west side opposite Luxor. At the site described above as "Crest of the Libyan Hills" (7·γ) for fourteen days from December 26, 1893, to January 8, 1894, the following mean results (Table (H)) were obtained; the mean results for Luxor and Assouan Roofs for the same period are also given.

TABLE (H).

Station.	Min.	Max.	Mean.	Range.
	°	°	°	°
Crest of Libyan Hills	51	65·5	58·2	14·5
Luxor . . .	42	72·5	57·2	30·5
Assouan . . .	46	71·0	58·5	25·0

We have noted that this station was 300 to 400 feet above the Nile valley and overlooking it, separated from the cultivated land by a third of a mile of desert, exposed entirely to the wind from the north-west and north which prevails here as at Luxor, but which on this side of the river will have passed over at least 50 to 60 miles of desert, to the north, and a far greater extent to the north-west, the river and cultivation north of this point taking a long bend to the east. The results are remarkable. The mean minimum was 5° higher than at Assouan, and 9° higher than at Luxor Roof. The mean maximum was 7° lower than on Luxor Roof, and 5°·5 lower than at Assouan. The mean temperature was 1° warmer than at Luxor, and the range was only 14°·5. It would appear that, as far as the minima are concerned, the positions at Luxor and at Assouan are both under the influence of the lower strata of air, which, over the cultivated land, and to a less extent over the river, are much colder than the air of the desert at night. The air over the river is probably about the same temperature at night as that over the roofs of buildings adjacent. During the period of observation on the Libyan Hill Crest there was a considerable amount of wind at most times of the day, and for one night in three it blew very strongly, from soon after sunset till 2 a.m., as indicated by vibration of the recording pen.

The next desert station was (7·β), the *Valley of the Tombs of the Kings*; the Table (I) shows that for the comparable periods, the Valley of the Tombs of the Kings was in the minimum 4° warmer than Luxor Roof,

and 3°·7 cooler in the maximum. This difference in the maximum would disappear if the Stevenson screen had stood in the sun's rays, 4° being the correction for shade here; therefore the valley of the Kings' Tombs had practically the same maximum, and the range was 4°

TABLE (I).

1894.	Luxor Roof.				Valley of the Tombs of the Kings.			
	Min.	Max.	Mean.	Range.	Min.	Max.	Mean.	Range.
	°	°	°	°	°	°	°	°
Jan. 9-31	45	73	59·0	28	49	67	58	18
Feb. 1-21	48	76	62·0	28	52	72	62	20
March 6-25	57	88	72·5	31	61	87	74	26
Means	50	79	64·5	29	54	75·3	64·7	21·3

less than at Luxor. The absolute minimum was 44°. It will be noted that if we add the correction for shade, the maximum would be the same at both places in February, 2° lower in the valley in January, and 3° warmer in March.

The third desert station was that described as (7·*a*) in the west portion of the Nile valley opposite Luxor, and consisted of two series: (1) December 3, 1894, to January 11, 1895, on the roof of a house (Abder-ra-soul), west of the Ramasseum, about 300 yards from the cultivated land, and 150 yards from the hills farther to the west; (2) January 12 to February 11, 1895, on the same side, a mile and a half in the desert west of Medinet Habou, the hills approaching the screen about 60 yards to the north, and 150 yards to the west. The screen stood on the limestone desert. The Table (J) shows that there is a difference of 3° at these stations, and Luxor Roof in the minimum, but

TABLE (J).

Station.	Luxor Roof.				Luxor Desert West.			
	Min.	Max.	Mean.	Range.	Min.	Max.	Mean.	Range.
	°	°	°	°	°	°	°	°
Dec. 3, 1894–Jan. 11, 1895	48	76	62·0	28	50	76	63	26
Jan. 12, 1895–Feb. 11, 1895	47	78	62·5	31	51	75	63	24
Means	47·5	77	62·3	29·5	50·5	75·5	63	25

the difference was twice as great at the station farther in the desert than at the nearer one. The maximum was the same at the first station, but 3° lower than Luxor Roof at the second station farther in the desert. The range was less than on Luxor Roof. Thus the maxima at the western desert stations near Luxor were slightly depressed in the open desert compared with Luxor Roof, and much depressed at the height of 300 to 400 feet. The mean minima were less depressed at the lower desert stations, and much less depressed at the higher station, than at Luxor Roof.

The lowest mean weekly temperatures (coldest week) in the four winter months were :—

1893-94.	Mena	3rd week of Jan.	53°
	Luxor	4th week of Dec., and also of Jan.	56
	Assouan	4th week of Dec.	55
1894-95.	Mena	1st week of Jan.	57
	Helouan	4th week of Dec.	54
	Luxor		58
	Assouan		59
1895-96.	Mena	4th week of Jan.	53
	Helouan	1st and 4th weeks of Jan.	54
	Luxor	2nd week of Jan.	56
	Assouan	1st week of Feb.	60

The last week of the year was, in two years out of three, the coldest week in Upper Egypt.

The daily course of the temperature at the various stations will be seen from Table II. and Table (K), the changes being indicated at every two hours. In addition to such curves, there are often changes of 1° to 2°, sometimes even 3° to 5° occurring at irregular times, due to some local movement of air not equally warmed. These variations were less frequent at Helouan and Assouan and in the desert than at the other stations. We see from Table (K) that, if in Lower Egypt we start from the minimum at 6 a.m. (before sunrise), 17°·2 in the mean (December to March) will bring us to the maximum at 2 p.m. ; of this 2°·5 is added by 8 a.m., 7½° more by 10 a.m., 4°·7 more by noon, and 2°·2 more by 2 p.m. The reduction of temperature to the minimum is 1°·3 by 4 p.m., 4° by 6 p.m. (which includes the hour of sunset), 3°·5 by 8 p.m., 2°·4 by 10 p.m., 2°·1 by midnight and 1°·4 at 2 a.m., 1°·7 by 4 a.m., and 1°·2 by 6 a.m.

TABLE (K).—Showing the Mean Number of Degrees higher or lower than at the previous Observation for the Months of December 1895 to March 1896.

Hour.	Mena.	Helouan.	Luxor Roof.	Luxor Fields.	Assouan.
				Jan., Feb., Mar. 17 to 23	
	°	°	°	°	°
2 A.M.	− 1·2	− 1·7	− 2·6	− 3·4	− 2·7
4 ,,	− 1·6	− 1·8	− 2·6	− 1·5	− 3·1
6 ,,	− 1·3	− 1·1	− 2·0	− 0·5	− 1·9
8 ,,	+ 2·1	+ 3·0	+ 6·4	+ 9·9	+ 6·9
10 ,,	+ 7·7	+ 7·8	+ 9·0	+ 11·3	+ 10·3
Noon.	+ 4·4	+ 5·1	+ 5·6	+ 7·0	+ 6·8
2 P.M.	+ 2·2	+ 2·1	+ 3·2	+ 2·7	+ 2·6
4 ,,	− 1·5	− 1·2	...	− 0·7	− 2·1
6 ,,	− 4·0	− 4·3	− 6·2	− 10·8	− 6·9
8 ,,	− 3·5	− 3·4	− 4·2	− 6·2	− 5·6
10 ,,	− 2·5	− 2·3	− 3·2	− 3·3	− 2·0
Midnt.	− 2·0	− 2·2	− 3·4	− 4·5	− 3·3

In Upper Egypt (Luxor Roof and Assouan), 25°·3 have to be reached by 2 p.m. It is observed that 6°·6 are added by 8 a.m., 9°·6 more by 10 a.m., 6°·2 by noon, and 2°·9 by 2 p.m. A difference, however, occurs in the downward course of the temperature ; at 4 p.m. we find a diminution of 2°·1 at Assouan, whilst the reading at Luxor is the same as the maximum at 2 p.m. At 6 p.m. there is a fall of 6½°, at 8 p.m. 4°·9, at 10 p.m. 2°·6, at midnight 3°·4, at 2 a.m. 2°·6, at 4 a.m. 2°·8, and at 6 a.m. 2°.

From these figures it will be observed that in Upper Egypt the increase of temperature at 8 a.m. is greater proportionately than in Lower Egypt, which will be seen to be in relation to the lower relative humidity of Upper Egypt.

The course of the temperature in the cultivated land is exhibited at Luxor Fields, where the range is 32° or 33°, and differs from Luxor Roof by the very rapid rise from 6 a.m. to 10 a.m., so that in four hours from the minimum a rise of 21°·2 has been attained; the course then follows that of Luxor and Assouan till 6 p.m., when in two hours it has dropped 10°·8, and this drop is still continued to 8 p.m. It then follows again that of Luxor and Assouan Roofs, with the exception that the approach to the minimum is more nearly reached by 4 a.m.

The increase of temperature from 6 a.m. to 10 a.m. is remarkable; in January at 8 a.m. 4½° are gained, and 14° more by 10 a.m.; in February the gains in these hours are 9½° and 13½°, and in March 15½° and 6½°, the occasional mists over the fields in January not clearing till 10 a.m., but in February and March they clear away earlier. The fall at 6 p.m. increases towards March, and that at 8 p.m. decreases to the same month. At Luxor Roof, the access of temperature at 8 a.m. is, in February and March, twice that of January, and the same is observed at Helouan and Mena House in Lower Egypt, but not till March.

With regard to the fall of temperature at sunset, much has been said by nearly every one who has ever travelled in Egypt, and it has often been described as very great. So far as these continuous observations show, the fall of temperature from 4 p.m. to 6 p.m. (including the hour of sunset) is only 1° more than that for the following two hours to 8 p.m. in Lower Egypt, whilst in Upper Egypt the fall from 4 p.m. to 6 p.m. is only 2° more than that for the following two hours. In the desert, the reduction of temperature from the maximum to the minimum is gradual, though rather more rapid up to 6 p.m. than after that hour.

In the cultivated land the fall from 4 p.m. to 6 p.m. is 11°, being three times that at Mena House or Helouan, and about twice that at Luxor Roof or Assouan, and under these conditions it is true that a very rapid cooling goes on; but even in this case, it is not all limited to the actual time of sunset. On examining the temperature curves more closely, we find that in the desert in Upper Egypt always, at Helouan generally, at Mena House frequently, on Luxor Roof generally, and at Assouan nearly always, the time of sunset is not marked by any appreciable extra fall of temperature, the downward curve is not disturbed. At other times, occurring as indicated, the exceptions take place, so that at Mena House a fall of 3° to 5° is frequently noticed in a quarter of an hour; at Helouan a fall of 1° to 2° might only occasionally be noted; a fall of 3° to 5° at Luxor, perhaps once a week, depending upon the presence of a breeze from the cultivated land, or exceptional conditions; and at Assouan a fall of 2° to 3° would be exceptional.

The sudden absence of the direct sun's rays at sunset gives the sensation of a fall of temperature, which, however, is nervous in origin, and produced by changes at the surface of the body. Dr. Marcet[1] has drawn attention to the length of time required after sunset before the sensation of "chill" is experienced.

[1] *Quarterly Journal of the Royal Meteorological Society*, vol. xi. p. 275.

It has been observed that the changes of temperature at sunrise are striking at all the stations, and at Helouan, Luxor "fields" and "roof," Assouan, and in the desert, sunrise is marked by a sudden steep rise from the minimum point, so precise, that in the case of one instrument, the clock of which was irregular, it has been possible by this means to estimate the error, when not noted otherwise.

General Conclusions on the Temperature.

The range of temperature will be controlled by the influences which affect the maximum and minimum. In Egypt the accession of temperature to the maximum is influenced mainly by the diathermancy of the air, which is directly controlled by the relative humidity. In the coldest month of the year, the access of temperature is slow. At stations such as Mena House and Luxor, though to a much less extent, the occasional mists of the early morning are late in clearing, owing to the influence of cultivation at either place. This condition, however, has in Upper Egypt almost entirely disappeared a few weeks later, and the access of temperature is then largely before 8 a.m. At stations where the influence of cultivation is slight, as at Assouan and Luxor, compared with stations such as Mena House, and to a less extent, Helouan (both the latter stations being influenced by the cultivation of the whole Delta, whereas Upper Egypt is mostly under the influence of the desert, and only a small strip of cultivated land), the approach to the maximum is earlier, and the curve remains longer at a high level than at the stations of Lower Egypt. The presence of cultivation, either in the immediate neighbourhood, as in the fields in still weather, or closely approximated, has the effect of rapidly reducing the temperature just before sunset and for the following two or three hours, and then maintaining a fall to a far lower minimum than at neighbouring stations less influenced by cultivation, so that a difference of 15° or even 20° may be found at 6 a.m. between stations only 3 miles apart. On still nights the effect of cultivation is closely limited to its own area, and may not affect the neighbouring road 6 feet above. It is probable that the lower temperatures do not extend much above the lower strata of air, as we have seen on the crest of the Libyan Hills overlooking the Theban plain.

These conditions are all changed if there be wind; then the night temperature at a given spot, depending upon cultivation, is not lowered to anything like the same extent if the wind is strong enough to bring in the desert air, the area of cultivation being small as in Upper Egypt.

But at certain stations situated, as Mena House, close to cultivation, and Helouan in the track of the wind from a very large area of cultivation—the Delta—the effect of a breeze from this direction would be the reverse, viz. to depress the temperature at night. At Luxor, the presence of cultivation to the north side of the town, the wind, if any, being from the north, influences that side of the town only, and does not extend over the half mile of sun-heated houses intervening between the north side of the town and Luxor Hotel, situated on the south side. Should the wind be strong enough to pour in this colder air from the north, it must inevitably bring in the warmer air from the desert. The cultivation 50 yards to the south of Luxor Hotel has probably no effect

on the temperature of Luxor Roof, the prevailing wind being from the North or North-west. At an elevated station in the desert, near Luxor, we have seen that under the influence of the prevailing wind from the desert, the range of temperature was very small, and the minimum depressed only slightly.

Thus we see the immense influence of local conditions in Egypt on the night temperature; stations a long way off in the desert may, by the wind, be placed under the influence of cultivated land.

The presence of water in large quantity, as a river or lake, does not lower the temperature of the air at night so much as the presence of a small quantity of water, to effect the evaporation of which heat must be taken from the surrounding air, and the rapidity of evaporation in Egypt is more easily compensated for from a large amount of water at a relatively high temperature than from a very small amount protected from the sun's rays by growing crops.

The presence of high growing crops and a slightly humid broken-up soil, even though the soil be dry at the surface, affords in Egypt the best means of obtaining rapidly a low temperature after sunset and through the night. The very low relative humidity in the day tends to the evaporation of an enormous quantity of moisture from the fields; the heat required to effect this evaporation is obtained from the direct sun's rays. After sunset the evaporation has still to continue, though to a progressively less extent; the large supply of heat from the direct sun's rays has been removed, and the temperature of the earth has been little raised during the day, owing to the protection afforded by the crops, hence the heat required must be taken from the lower strata of the air.

Equally powerful, or more so, in rapidly reducing the temperature after sunset, is the rapidity of radiation; the slightly heated earth beneath the crops will more rapidly radiate its heat than the highly heated desert, and the curve of cooling will be more abrupt in the one case than in the other. The problem of the relative amounts of reduction of temperature, due to radiation and evaporation respectively, remains to be solved. Dr. Marcet[1] has recorded some very interesting experiments on radiation in Egypt, and on the cooling of the Nile by night from these two causes, but the relative influence of the two factors remains unsettled.

The lower relative humidity of Upper Egypt and the desert, with only a slight visible screen, if any, in the air, as compared with the frequent cloudiness of Lower Egypt, allows radiation and evaporation to proceed far more rapidly, hence the effects produced by cultivation are more strongly marked in Upper Egypt, and the daily range of temperature is larger and reaches the highest recorded in the cultivated land. The rapidity of evaporation at times is so great, that a thin layer of water is frozen, when the surrounding air is several degrees above the freezing-point, and it is a common practice to cool a room rapidly as much as 10° by hanging a damp sheet before an open door or window.

Relative Humidity.

The automatic recording hair-hygrometers were made by Richard Frères of Paris, and all worked well when tested in one room in Cairo,

[1] *Quarterly Journal of the Royal Meteorological Society*, vol. xi. p. 275.

at the commencement. The standards were Casella's dry and wet bulb thermometers. The instruments were regulated at 10 a.m. on Mondays, at all stations following the same instructions. It was found that all the instruments, in the extremes of moisture or dryness, recorded these extremes as more extensive than the percentage, as calculated from the readings of the dry and wet bulbs, the high percentages reading too high by 2 per cent to 4 per cent, and the low percentages too low by 2 per cent to 4 per cent. It was found that all the instruments recorded in the same manner. No correction has been made for this error. Between 20 per cent and 80 per cent of the readings were found to be the same or very nearly the same (within 1 per cent) as those resulting from the dry and wet bulb method of calculation. An effort was made to approach uniformity by standardising the instruments at an hour (10 a.m.) when the percentage at most stations was about 50 per cent. Compared with the thermometric records, which were rarely found to be as much as 0°·2 out, the hygrometric records cannot be regarded as absolute, but within the limits mentioned they represent a reliable basis for a comparative view of the relative humidity as exhibited at the various stations under a uniform method of observation; and it must be noted that the mean relative humidity of Egypt is about 50 per cent, so that the error occurring in readings over 80 per cent is compensated for in arriving at the mean by that in the readings below 20 per cent.

The relative humidity follows closely the inverse order to the temperature, and therefore will be found to be much lower in Upper Egypt than in Lower Egypt, remaining low at night at desert stations where the temperature is not so markedly depressed, as is the case in the cultivated land. Stations in Upper Egypt such as Luxor, not actually in the cultivated land, but surrounded with a dry town on the north side, the town itself being in the midst of a cultivated plain, are not, we have seen in discussing the temperature, affected by that cultivation, except to a small extent. On Luxor Roof only about a quarter the effect due to cultivation is observed in the night temperature; in other words, "Luxor Hotel Roof" station approached three-quarters of the way to the actual desert conditions observed near Luxor, as compared with the cultivated fields half a mile to the south.

The total number of readings, every two hours for three years, has been averaged, and the means at these hours are shown in Table IX., from which table the six comparative tables (L-Q) have been extracted.

Table (L) gives the mean relative humidity for the four months December to March for three years, at each two hours of the day.

The years are found to vary slightly in the mean, and it must be observed that the months of March and December are not complete in every case at Assouan, and on one occasion at Luxor. The mean on Luxor Roof for the three years was 52·2 per cent, and at Assouan 40·9 per cent. The change each two hours on the previous reading is indicated, and differs at the two stations as follows: starting from 6 a.m., when the figures were Luxor 73·1 per cent, Assouan 61·1 per cent; up to 10 a.m. Luxor dries rather more quickly than Assouan owing to the more rapid recovery at sunrise from a depressed minimum temperature at Luxor; thence to 2 p.m. the change is the same at both places; at 4 p.m. at Luxor there is a slight increase, whilst at Assouan it is still diminishing slightly;

at 6 p.m. and 8 p.m. it rapidly increases at Luxor, slowly at Assouan; after midnight the increases to the maximum at 6 a.m. are larger at Assouan than at Luxor. In the type of a desert climate we shall see there is only a slight increase in the relative humidity up to midnight, and then rapid increases to the maximum at 6 a.m.

TABLE (L).—Relative Humidity, December to March, Three Years.

Station.	2 a.m.	4	6	8	10	Noon.	2 p.m.	4	6	8	10	Midn.	Mean.
	%	%	%	%	%	%	%	%	%	%	%	%	%
Luxor Roof 1893-94	65·6	69·0	72·9	65·9	48·5	38·9	33·1	33·5	42·9	50·6	54·3	59·7	52·9
Luxor Roof 1894-95	65·1	69·2	70·4	63·5	49·2	35·2	28·9	29·6	39·7	48·6	53·2	59·7	51·0
Luxor Roof 1895-96[1]	67·9	73·1	76·1	66·0	47·9	36·0	29·2	28·7	40·0	50·5	55·5	62·0	52·7
Mean	66·2	70·4	73·1	65·1	48·5	36·7	30·4	30·6	40·9	49·9	54·3	60·5	52·2
Assouan 1893-94[2]	50·1	60·0	64·0	61·6	46·7	35·7	28·0	27·1	30·7	35·9	40·9	46·5	43·9
Assouan 1894-95[3]	46·7	51·9	56·1	53·6	37·4	26·1	19·5	19·5	23·0	29·0	34·9	41·2	36·5
Assouan 1895-96[4]	52·4	58·1	63·1	59·5	44·2	32·6	24·9	23·1	27·9	34·4	40·4	45·9	42·2
Mean	49·7	56·7	61·1	58·2	42·8	31·5	24·1	23·2	27·2	33·1	38·7	44·5	40·9
Change each 2 hrs. on previous Reading. Luxor	+5·7	+4·2	+2·7	−8·0	−16·6	−11·8	−6·3	+0·2	+10·3	+9·0	+4·4	+6·2	...
Change each 2 hrs. on previous Reading. Assouan	+5·2	+7·0	+4·4	−2·9	−15·4	−11·3	−7·4	−0·9	+4·0	+5·9	+5·6	+5·8	...

[1] March 1-23 only. [2] March 1-22. [3] December 17-31, March 1-25. [4] December 9-31.

In Table (M) the relative humidity for January and February for two years are compared at the stations Helouan, Luxor, and Assouan. We find that at Helouan, as at Assouan at 8 a.m., there is not the rapid diminution of relative humidity that takes place at Luxor, for at both these stations the minimum temperature has not been depressed to the

TABLE (M).—Relative Humidity, January and February, Two Years.

Station.	2 a.m.	4	6	8	10	Noon.	2 p.m.	4	6	8	10	Midn.	Mn.
	%	%	%	%	%	%	%	%	%	%	%	%	%
Helouan 1895	64·0	66·5	68·0	65·7	49·7	38·7	33·2	34·2	40·7	46·2	54·2	59·5	51·7
Helouan 1896	70·0	73·0	72·5	67·7	52·2	42·5	37·5	39·5	47·5	53·7	60·5	65·0	56·8
Mean	67·0	69·7	70·2	66·7	50·9	40·6	35·3	36·8	44·1	49·9	57·3	62·2	54·2
Change on previous Reading	+4·8	+2·7	+0·5	−3·5	−15·8	−10·3	−5·3	+1·5	+7·3	+5·8	+7·4	+4·9	...
Luxor 1895	72·7	77·0	76·5	69·2	56·2	40·5	31·8	34·0	44·7	55·0	58·7	66·5	56·9
Luxor 1896	71·5	78·2	80·2	71·0	52·0	39·7	33·0	32·2	44·5	55·2	60·0	66·5	56·9
Mean	72·1	77·6	78·3	70·1	54·1	40·1	32·4	33·1	44·6	55·1	59·3	66·5	56·9
Change on previous Reading	+5·6	+5·5	+0·7	−8·2	−16·0	−14·0	−7·7	+0·7	+11·5	+10·5	+4·2	+7·2	...
Assouan 1895	47·7	53·7	58·2	55·5	39·7	27·0	18·7	19·0	22·2	28·0	34·9	41·2	37·1
Assouan 1896	53·5	59·5	64·7	62·5	47·5	34·7	27·0	24·7	29·2	36·0	41·7	47·5	44·0
Mean	50·3	56·3	61·4	59·0	43·6	30·8	22·8	21·8	25·7	32·0	38·3	44·3	40·5
Change on previous Reading	+6·3	+6·0	+4·8	−2·4	−15·4	−12·8	−8·0	−1·0	+3·9	+6·3	+6·3	+6·0	...

same extent as at Luxor. Throughout the day till 4 p.m. the conditions are about the same at all three stations, but at 6 p.m. the increase at Luxor is more than at Helouan, and at Helouan more than at Assouan. The process is then similar (excepting 8 p.m. at Luxor) at all three stations till 2 a.m., then at 4 a.m. the increases are still large at Luxor and Assouan, but at Helouan the maximum was nearly reached at 2 a.m. At 6 a.m. a large increase is added to Assouan, 0·7 per cent to Luxor, and only 0·5 per cent to Helouan. For these two months the relative humidity at Helouan was 2·7 per cent less than Luxor, though for the four winter months it is 3·7 per cent greater at Helouan than at Luxor.

TABLE (N).—Relative Humidity, January and February 1896.

Station.	2 A.M.	4	6	8	10	Noon.	2 P.M.	4	6	8	10	Midn.	Mn.
	%	%	%	%	%	%	%	%	%	%	%	%	%
Mena House . .	83·2	85·7	89·2	88·2	66·7	48·5	41·7	45·7	56·7	67·2	74·7	79·0	68·9
Helouan . . .	70·0	73·0	72·5	67·7	52·2	42·5	37·5	39·5	47·5	53·7	60·5	65·0	56·8
Luxor	71·5	78·2	80·2	71·0	52·0	39·7	33·0	32·2	44·5	55·2	60·0	66·5	56·9
Luxor Fields . .	94·7	97·2	97·0	90·7	61·0	48·5	44·0	47·5	69·0	80·7	83·2	88·7	75·2
Assouan . . .	53·5	59·5	64·7	62·5	47·5	34·7	27·0	24·7	29·2	36·0	41·7	47·5	44·0
2-Hourly change at													
Mena House . .	+4·2	+2·5	+3·5	−1·0	−21·5	−18·2	−6·8	+4·0	+11·0	+10·5	+7·5	+4·3	...
Helouan . . .	+5·0	+3·0	−0·5	−4·8	−15·5	−9·7	−5·0	+2·0	+8·0	+6·2	+6·8	+4·5	...
Luxor	+5·0	+6·7	+2·0	−9·2	−19·0	−12·3	−6·7	−0·8	+12·3	+10·7	+4·8	+6·5	...
Luxor Fields . .	+6·0	+2·5	−0·2	−6·3	−29·7	−12·5	−4·5	+3·5	+21·5	+11·7	+2·5	+5·5	...
Assouan . . .	+6·0	+6·0	+4·9	−2·2	−15·0	−12·8	−7·7	−2·3	+4·5	+6·8	+5·7	+5·8	...

Table (N) is comparative for the months of January and February 1896, at five stations.

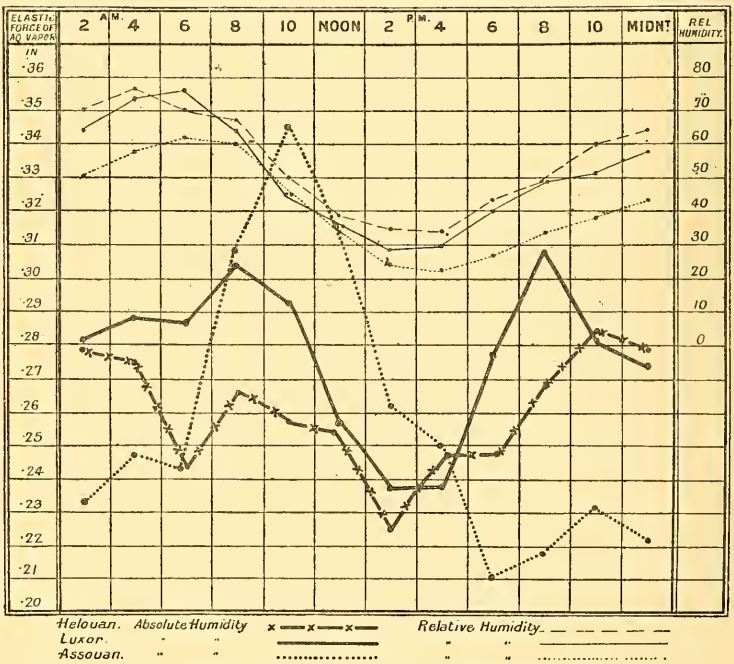

Fig. 2.—Absolute and Relative Humidity, February 1896.

In addition to Helouan, Luxor, and Assouan, which have already been referred to, we have here to consider Mena House and Luxor Fields.

At Mena House there is very little diminution of the relative humidity till 8 a.m., and at 10 a.m. it is still 14·5 per cent more than at Helouan, and 14·7 per cent more than at Luxor. At noon and at 2 p.m. the change follows in the same course as at the other stations. But at 4 p.m. at Mena House,

TABLE (O).—Luxor and Luxor Desert West. Three Months, January to March 1894.

Station.	2 A.M.	4	6	8	10	Noon.	2 P.M.	4	6	8	10	Midn.	Mn.
	%	%	%	%	%	%	%	%	%	%	%	%	%
Luxor	63·8	67·8	72·3	65·7	47·8	37·8	31·8	31·5	40·3	48·2	51·7	57·8	51·4
Luxor Desert[1] .	43·5	47·2	50·6	51·8	45·8	36·8	30·2	29·0	33·0	36·0	36·5	39·0	39·9
Change on previous Obs. Luxor.	+6·0	+4·0	+4·5	−6·6	−17·9	−10·0	−6·0	−0·3	+8·8	+7·9	+3·5	+6·1	...
Change on previous Obs. Luxor Desert.	+4·5	+3·7	+3·4	+1·2	− 6·0	− 9·0	−6·6	−1·2	+4·0	+3·0	+0·5	+2·5	...

[1] March 1-26.

the increase is well started, and continues in advance of Helouan till 8 p.m. The additions through the night to 6 a.m. correspond nearly to those of Helouan; at both these stations more is added before midnight than after.

At "Luxor Fields" station the additions to the relative humidity were very great at 6 p.m. (21·5 per cent) and at 8 p.m., the additions later were small, 94·7 per cent being reached at 2 a.m.

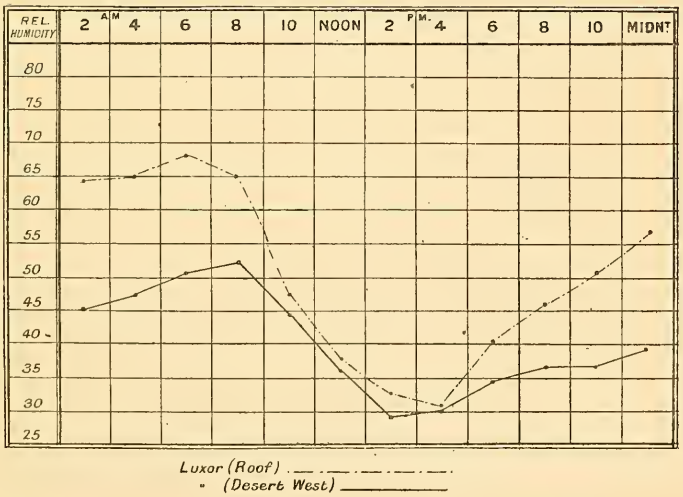

Fig. 3.—Relative Humidity, Luxor (roof) and Luxor Desert West (Valley of the Tombs of the Kings), February 1894.

Table (O) gives the differences for the three months January to March for one year (1894) at Luxor Roof and in the Desert West of Luxor

(stations: "Crest of the Libyan Hills" from January 1 to 8, and the "Valley of the Tombs of the Kings" from January 8 to March 26).

The relative humidity by night of the desert station was not much greater than that by day; it was, however, at its maximum at 8 a.m. instead of 6 a.m., as at Luxor, owing to its position in a valley with high hills to the east obstructing the sun's rays. The diminution to 10 a.m. was slight only, and the mean minimum was not reached till 4 p.m.; 6 p.m. only added 4 per cent as compared with 8·8 per cent at Luxor, and very little was added by midnight to reach only 39 per cent; after midnight more was added than before, whilst at Luxor the reverse was the case.

Table (P) compares again Luxor Desert West [the stations being those described as ($7 \cdot \alpha$) in the Nile valley, but removed from the cultivated land by 300 yards from January 1 to 12, by 2 miles from January 12 to February 11. After February 11 in the Valley of the Tombs of the Kings at the station already described as ($7 \cdot \beta$)] with Helouan, Luxor, and Assouan.

TABLE (P).—Helouan, Luxor Roof, Luxor Desert West, and Assouan, January and February 1895.

Station.	2 A.M.	4	6	8	10	Noon.	2 P.M.	4	6	8	10	Midn.	Mean.
	%	%	%	%	%	%	%	%	%	%	%	%	%
Helouan . .	64·0	66·5	68·0	65·7	49·7	38·7	33·2	34·2	40·7	46·2	54·2	59·5	51·7
Luxor . . .	72·7	77·0	76·5	69·2	56·2	40·5	31·8	34·0	44·7	55·0	58·7	66·5	56·9
Luxor Desert W. .	51·7	57·5	63·0	62·5	49·7	37·5	29·2	28·7	34·2	36·2	39·2	44·5	44·6
Assouan . .	47·7	53·7	58·2	55·5	39·7	27·0	18·7	19·0	22·2	28·0	34·9	41·2	37·1
Change on previous Observation. Helouan	+4·5	+2·5	+1·5	−2·3	−16·0	−11·0	−5·5	+1·0	+ 6·5	+ 5·5	+8·0	+5·3	...
Change on previous Observation. Luxor .	+6·2	+4·3	−0·5	−7·3	−13·0	−15·7	−8·7	+2·2	+10·7	+10·3	+3·7	+7·8	...
Change on previous Observation. Luxor Desert	+7·2	+5·8	+5·5	−0·5	−12·8	−12·2	−8·3	−0·5	+ 5·5	+ 2·0	+3·0	+5·3	...
Change on previous Observation. Assouan	+6·5	+6·0	+4·5	−2·7	−15·8	−12·7	−8·3	+0·3	+ 3·2	+ 5·8	+6·9	+6·3	...

Again we find the desert has not reached its maximum till 8 a.m., but this was not the case during the time that the instruments were exposed in the Nile valley, receiving the sun's rays at sunrise, and it is therefore only a local effect in the Valley of the Tombs of the Kings. The dryness of the day is found to persist, as in the valley, to 4 p.m., and, as at that station, the increase of relative humidity is very slight up to midnight, but after midnight is more marked.

Table (Q) is only for 7 days (Jan. 1 to 7, 1894), and is comparative of the relative humidity at the desert station ($7 \cdot \gamma$) on the "Crest of the

TABLE (Q).

Station.	2 A.M	4	6	8	10	Noon	2 P.M.	4	6	8	10	Mid-night.	Mean.
	%	%	%	%	%	%	%	%	%	%	%	%	%
Crest of Libyan Hills .	48	52	55	48	46	42	39	37	42	42	42	43	45
Luxor Roof . .	73	83	85	77	55	46	40	39	52	58	65	70	62
Change on previous Observation. "Crest"	+5	+ 4	+3	−7	− 2	−4	−3	−2	+ 5	0	0	+1	...
Change on previous Observation. "Roof"	+3	+10	+2	−8	−22	−9	−6	−1	+13	+6	+7	+5	...

Libyan Hills" and Luxor Roof for the same days. For the reasons mentioned in discussing the temperature, this station is more under the influence of the desert than any other in this series of observations, and therefore it will be taken as the type of the desert conditions as to relative humidity. It is also important on account of its altitude, about 300 to 350 feet. As we have shown, the effects of cultivation in reducing the night temperature and therefore increasing the relative humidity, are purely local, and on still nights do not extend to the adjacent road, so probably the increase in relative humidity over cultivated land does not extend above a few feet from the ground. In the cultivated land after sunset a thin film of mist is observed, not more than a few inches thick, over the crops, and dipping into a cultivated ditch in the same

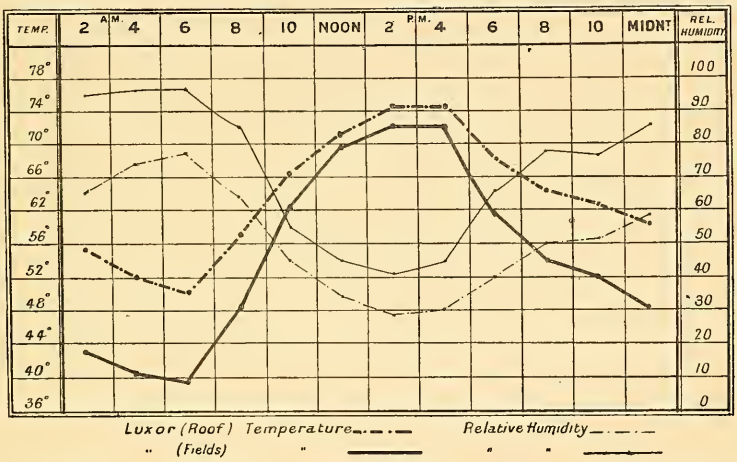

FIG. 4.—Temperature and Relative Humidity, Luxor (roof) and Luxor Fields, February 1896.

manner as a curved film. The air above this film is probably warmer than at the film, below the film it is probably cooler than at the film, but having already deposited some of its moisture, there is not sufficient remaining to form a mist below, even at the lower temperature. The elevated desert station is probably, taking into consideration the predominant North-west wind and the presence of open desert for 60 miles to the north, and for an unlimited distance to the north-west, the station the most removed from the effects of cultivation. Facing the unobstructed rising sun, it is not open to the objections that might be raised as to the station in the valley of the Kings' Tombs. The changes in this typical station are as follows:—Starting from the maximum (55) at 6 a.m., 18 per cent reduction took place by 4 p.m.; the minimum (37) being reached, 7 per cent was attained out of this 18 per cent in the first two hours by 8 a.m., a large proportion considering that at Luxor Roof 46 per cent reduction took place up to 4 p.m., of which only 8 per cent was attained by 8 a.m. The minimum was not attained till 4 p.m., which is unusual in Egypt, although the minimum may be maintained till that hour at Assouan. Out of the 18 per cent daily variation in the relative

humidity, 5 per cent is attained at 6 p.m., and there is no further addition till midnight, when 1 per cent is added. After midnight 5 per cent, 4 per cent, and 3 per cent are added before 6 a.m. Thus only one-third the increase in relative humidity, from the minimum by day to the maximum at 6 a.m., is attained by midnight, and the remaining two-thirds in the six hours after midnight.

At Luxor Roof, out of a daily variation of 46 per cent, two-thirds were added before midnight, and only one-third after. We have seen that in the fields themselves the actual proportion is four-fifths before midnight and only one-fifth after. In the two cases, the "Libyan Hill Crest" and the Theban cultivated plain, we see two extremes of the conditions which vie with each other to influence the climate of Egypt, and other stations recorded in this paper will be shown to be intermediate. Hardly a station can be found in Egypt where the two influences are not commingled in varying proportions, and therefore to find comparable sites in Egypt, or to calculate the exact equivalent of local conditions, is a problem of some difficulty. If the original object of this research had been pure meteorology, perhaps more interesting results would have been obtained from desert stations on the western side, in varying latitudes sufficiently removed from the Nile valley to place them entirely under the influence of the desert with the generally prevailing North-west or North wind; but as the object was to ascertain the precise conditions under which invalids live who visit Egypt during the winter, it was necessary to select the stations at the actual places of resort. It was thought that such a research, by its general character, might in the future be of use in the selection of sites advisable as resorts, and in tending to a scientific use of the climate by artificial methods adapted to the variations found to exist.

We stated that all other stations, recorded in this series, were intermediate between the climates to be found in the cultivated Theban plain at Luxor, and the "Libyan Hill Crest" opposite Luxor. We will first take Mena House. We have seen that the proportion of relative humidity increase is in the "fields" at Luxor, four-fifths before midnight, and one-fifth after, and the proportion for the "Libyan Hill Crest" is one-third before midnight, and two-thirds after; now at Mena House for the four months, December to March 1895-96, the proportion is exactly the same as in the "Luxor Fields," that is, Mena House is as much under the influence of cultivation as the Luxor Fields. We have shown that whenever there is a moderate breeze, which is very frequent by day, Luxor Fields are certainly under the influence of the desert, whereas at Mena House, when the wind is from the North or even slightly to the West of North, which is frequently the case, the influence of the cultivated Delta is inevitably brought to bear. At night the influence of the cultivation at "Luxor Fields" is very great owing to the frequent calms, and at Mena House the same influence is strongly felt owing to the proximity (only a few yards removed) of cultivated land to the east and north. As there is no place in Egypt which is under the influence of cultivated land only, so the station "Luxor Fields," separated from unlimited desert by only two or three miles of cultivated land, is almost always by day, and frequently by night, brought under the desert influence by means of the wind, so to a similar extent is Mena House under desert influence, by means of those days and nights on which there is a breeze from the South,

the West, or possibly North-west. On the nights when the wind is from North or North-north-west, and probably on calm nights on the side of the house near the cultivation, the influence of the cultivated land is marked.

Helouan and Luxor.—At both places the proportion is the same, the added relative humidity is three-quarters before midnight, and one-quarter after. The influence of cultivation at both stations is equal, and both are intermediate between Mena House and Assouan. At first sight, one would have expected Helouan, placed south of Cairo with 15 miles of desert to the north and 2 miles to the west, to be entirely under the influence of the desert, but this is not so. The question of the wind comes in, bringing the climate, and in the case of Helouan, whenever there is a wind, it is as at Mena House, mostly from the North or North-west, and passes over the cultivated Delta, or crosses the river, with its cultivation on either bank, to the west of Helouan.

At Luxor Roof we have shown that if there is calm, it is three-quarters of the way from cultivated land conditions to desert conditions. If there is a slight breeze it would be under the influence of modified cultivated land conditions; if the breeze be stronger it is under the influence of desert almost entirely. It is a question of Luxor in a small area of cultivated land and a mass of desert beyond, and Helouan in a small area of desert and receiving, by means of the wind, the effect of a mass of cultivation beyond, and the influences appear in the mean to balance each other.

Assouan approaches more nearly to the type of the "Libyan Hill Crest," being in the proportion a little more than a half before midnight, and rather more than a half after. If the station at Assouan had been on the west side of the river instead of the east, and two or three miles to the west, it would have closely approximated to the "Libyan Hill Crest." There is very little cultivation immediately to the north of Assouan, yet the prevailing wind is in the line of the river from North to South here, and although the river does not act as markedly as cultivation, it has an influence of the same kind though less in degree.

The lowest mean minimum relative humidity for any month was 13 per cent at 2 p.m. from March 1 to 22, 1894, and at 4 p.m. in March 1895, and occurred at Assouan. The lowest mean minimum for any month at Luxor was 18 per cent in March 1895 at 2 p.m. and 4 p.m.

The lowest minima of relative humidity recorded by the hair hygrometer were :—

At Assouan—

	Per Cent.
March 12, 1896, 4 p.m.	4.
Feb. 26, 1896, 2 p.m., 4 p.m., and 6 p.m.	3.
The temperatures being 102°, 96°, and 90°.	
Feb. 14, 1895, same hours	1, 0, 4.
Feb. 17, 1895, same hours	0, 0, 3.
Feb. 18, 1895, same hours	0, 0, 4.
Feb. 19, 1895, same hours and 8 p.m.	0, 0, 0, 0.
March 14, 1895, noon, 2 p.m., 4 p.m., and 6 p.m.	3, −1, −2, 0.
March 15, 1895, same hours	2, 0, −2, 5.
March 20, 1894, 2 p.m., 4 p.m., and 6 p.m.	0, 0, 3.
March 21, 1894, same hours	0, 0, 5.

Valley of the Tombs of the Kings.

March 19 and 20, 1894. The relative humidity did not exceed 27 per cent, and the minimum was 6 per cent; for the following two and a half days it did not exceed 18 per cent, and the minimum was 7 per cent. This period of five days had the lowest recorded relative humidity for a series of days. It will be observed that on two days at Assouan the recording pen actually passed below the zero of the scale.

The number of nights in the winter of 1895-96 on which the relative humidity reached 100 per cent were :—

Mena House in Dec. and Jan. 18, Feb. 22, March 24.
Luxor in Dec. 3, in Jan. 9, in Feb. 1, in March 0.
Luxor Fields in Jan. 29, in Feb. 27, in March 17 (out of 22).
Desert West of Luxor, Helouan and Assouan, 0.

The mean dew-point in Luxor Fields was in January 36°·5, in February 38°, and in March 53°. In Fig. 5 the influence of the wind in reducing the relative humidity at Luxor Fields station is shown. The force of wind and relative humidity were calculated from 5 p.m. to 5 p.m. The total miles of wind were recorded by a Robinson anemometer.[1] The relative humidity is the mean of the twelve readings of the twenty-four hours. With a rise in the force of the wind we have a fall in the relative humidity. The chart has been given to show the influence of the wind in changing the conditions due to local causes.

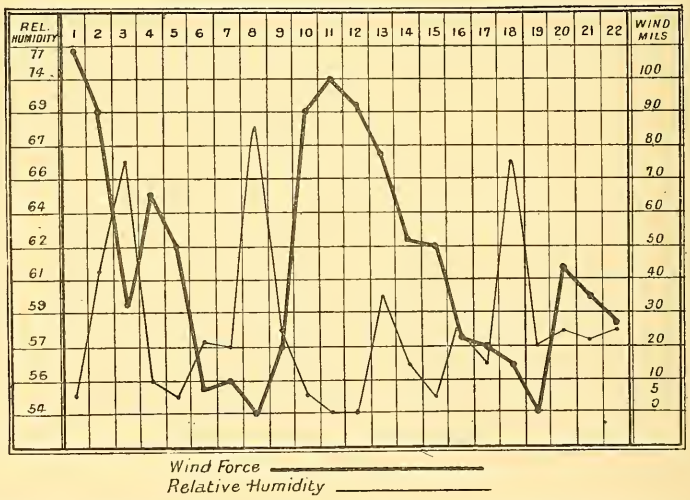

Fig. 5.—Relative Humidity and Force of Wind, Luxor Fields, March 1-22, 1896.

Absolute Humidity.

The following comparative Table (R) and Fig. 6 show the absolute amounts of humidity in the air at the four stations, Mena House, Helouan, Luxor, and Assouan, taken at each two hours of the day and night for the four winter months December to March 1895-96.

[1] The anemometric figures are by the permission of Dr. Page May, for whom they were taken at Luxor.

We see that the absolute humidity varies at these stations between 39 grains per 10 cubic feet as a daily mean at Mena in December to 25 at Assouan in January.

TABLE (R).—Mean Absolute Humidity (grains in 10 cubic feet of air).

1895-96.	Mena Ho.	Helouan.	Luxor Roof.	Assouan.	Mean.
	gr.	gr.	gr.	gr.	gr.
Dec. .	39	32	33	31	34
Jan. .	32	28	31	25	29
Feb. .	34	29	30	28	30
March .	36	31	31	29	32
Mean .	35	30	31	28	31

The absolute humidity (30) at Helouan is considerably less than at Mena (35), and one less than at Luxor for the whole winter. At Assouan it is least, being only 28.

The absolute humidity, in the mean of the four stations, is greatest in December, least in January, and slowly advances in February and March. At the individual stations this order is preserved, except at Luxor, where it is least in February.

Fig. 6 shows the changes each two hours at these stations for February 1896. In this chart is included the curve for the same time of the

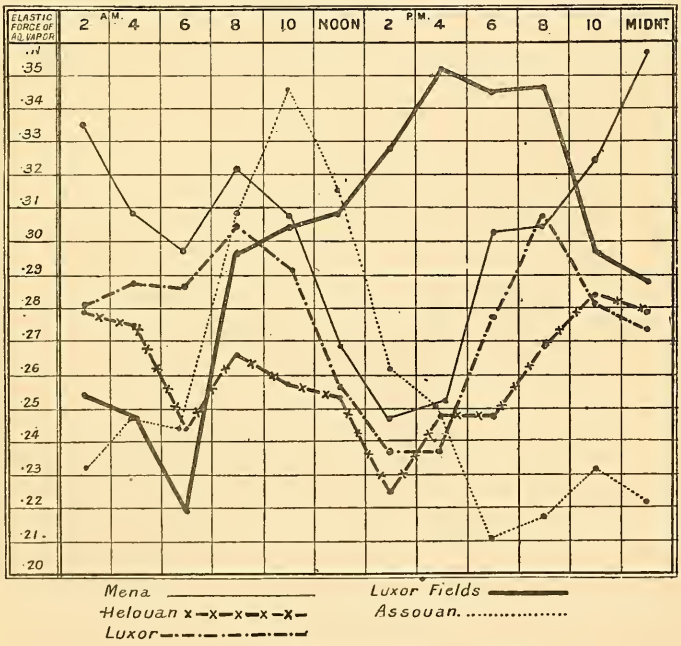

Fig. 6.—Absolute Humidity, February 1896.

absolute humidity in the Luxor Fields. In the mean of the twelve hours of the day (8 a.m. to 6 p.m.), as compared with the twelve hours of the

night (8 p.m. to 6 a.m.), Mena House, Helouan, and Luxor, are drier by day by 2 grains in the case of Mena and Helouan, and 1 grain in that of Luxor, whereas at Assouan the air is 4 grains drier by night than by day. The curves at 8 a.m. and 10 a.m. at all the stations showed an increase of absolute humidity, this increase being occasioned by the increased temperature of the air enabling a greater amount of moisture to be taken up. In cases where there is little if any moisture available, during still conditions, as at Helouan and in the Valley of the Tombs of the Kings (as will be seen later), the increase is, if any, very slight.

In the Luxor Fields and at Mena House, dew is taken up; the occasional movements of the air from the neighbouring cultivation accounting for the increase at Luxor Roof on those days on which dew was not deposited in the vicinity of the roof. At Helouan the increase is least at these hours owing to the small amount of moisture available. At Assouan the rising breeze up the channel of the river affords the increase exhibited, which has not passed away at noon, when the other stations are drier. During the remainder of the day till 6 p.m., the usual day breeze is able to keep the stations under desert influences, with the exception of the cultivated land station, where the curve represents the mean between those days on which the wind is strong with a low relative humidity as we have shown, and those days on which the wind was slight or calm, with a high relative humidity. The mean curve resulting is decidedly in favour of the possibility of increased absolute humidity up to 4 p.m. in Luxor Fields; in other words, the days with little or no wind overbalance those with sufficient wind to bring in desert conditions. Such is the influence of cultivated land on the absolute humidity by day.

At night (6 p.m. and 8 p.m.) there is an increase of absolute humidity at Mena House, Helouan, and Luxor, commencing at 4 p.m., but being less marked at Helouan than at the other two stations; by midnight it is far greater at Mena House than at Helouan and Luxor Roof, at which stations it is about the same. At Assouan the dryness increases at 6 p.m., and it remains very dry till 2 a.m. In the Luxor Fields the absolute humidity falls after 8 p.m. when dew has probably been deposited, but at Mena House the dew-point would not be reached till after midnight as a rule. After midnight the absolute humidity falls at Mena House, Helouan, and Luxor Fields till 6 a.m., which is the hour of the minimum absolute humidity in the fields, the air being then very dry, nearly as dry as the air of Helouan at 2 p.m.

Fig. 7 shows the course of the absolute humidity in the Valley of the Tombs of the Kings, at the station described above, compared with the same 6 days on Luxor Roof and at Assouan. The air is even drier at this station through the whole twenty-four hours than at either of the other two stations, excessive dryness being attained at 2 p.m. In the previous hours of the morning, there being no moisture available, the absolute humidity remains stationary. The absence of any dew deposit in the night in the neighbourhood does not occasion any appreciable increased dryness on this account.

The mean dew-point at "Luxor Fields" was in January 36°·5, in February 38°, and in March 53°.

In February 1894, the mean dew-point at 6 a.m. in the Valley of the

Tombs of the Kings was 35°, the mean temperature at that hour being 52°. At 2 p.m. in the same month the mean dew-point was at 38°·5, whilst the mean temperature was 72° or over 33° above the dew-point.

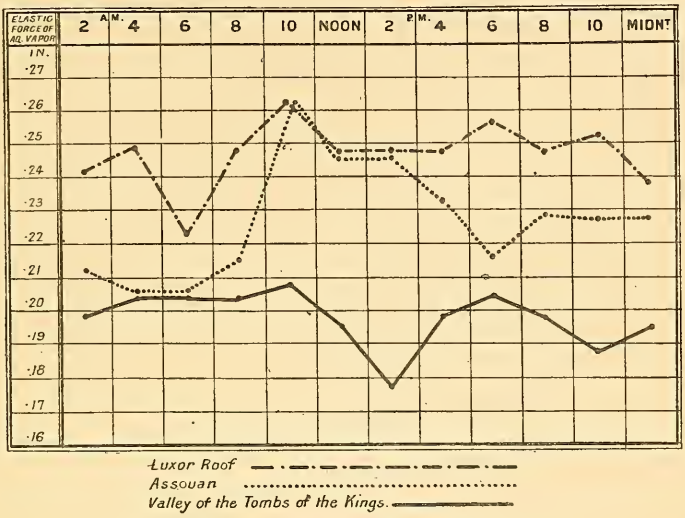

Fig. 7.—Absolute Humidity, February 13-18, 1894.

At Luxor Roof the corresponding dew-points were 37°·5 and 43°·5, and at Assouan 0°·5 lower by night and 1° lower by day than at Luxor Roof.

Rain, etc.

Rain was not recorded.

The rainfall at Mena House and Helouan is less than at Cairo. At Luxor and Assouan rain is rare, and occurs to about the same extent at both stations.

At Luxor in 1893-94 it rained once in December a few drops only.

In 1894-95, it rained once in December for three-quarters of the day, not heavily. Once it rained in March a few drops only, the relative humidity being 40 per cent at the time, and a strong Khamseen wind blowing.

In 1895-96 rain fell once in February, a few drops only at 11 p.m.

Thunder was heard twice in five winters at Luxor.

TABLE I.—Temperature at all Stations, showing the Months complete and incomplete.

Stations.		1893–94.						1894–95.							1895–96.						
		Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.
Cairo.	Min.	° ...	° ...	° ...	° ...	° ...	° ...	[3] ° 57·2	° 50·5	° 45·8	[4] ° 52·5	° 49·6	[5] ° 57·1	° ...	[6] ° 55·5	[7] ° 54·1	[8] ° 46·2	° 47·7	° 51·1	° 53·2	° ...
	Max.	...	...	...	...	...	...	73·7	69·3	68·1	77·9	73·0	86·0	...	72·6	70·8	63·7	69·5	74·6	79·9	...
	Mean.	...	...	...	...	...	...	65·4	59·9	56·9	65·2	61·3	71·5	...	64·0	62·4	55·0	58·6	62·8	66·6	...
	Range.	...	...	...	...	...	...	16·5	18·8	22·3	25·4	23·4	28·9	...	17·1	16·7	17·5	21·8	23·5	26·7	...
Mena House.	Min.	...	48·9	45·7	46·6	48·2	[2] 53·4	[9] 57·0	[10] 49·2	47·6	[11] 51·2	51·2	57·0	[12] 59·4	[13] 54·9	50·9	45·6	47·7	50·5	[14] 54·9	...
	Max.	...	68·5	65·2	69·3	72·1	77·4	75·6	67·2	71·4	77·7	75·4	84·5	85·9	71·5	69·9	63·6	68·5	73·8	79·5	...
	Mean.	...	58·7	55·4	57·9	60·1	65·4	66·3	58·2	59·5	64·5	63·3	70·8	72·6	63·2	60·4	54·6	58·1	62·1	67·2	...
	Range.	...	19·6	19·5	22·7	23·9	24·0	18·6	18·0	23·8	26·5	24·2	27·5	26·5	16·6	19·0	18·0	20·8	23·3	24·6	...
Helouan.	Min.	...	...	...	...	...	...	[15] 55·7	48·8	46·0	51·1	51·7	[16] 60·2	...	57·2	50·8	45·7	49·1	52·0	58·1	[17] 66·3
	Max.	...	...	...	...	...	...	75·7	69·7	70·3	77·2	77·6	88·5	...	76·9	70·5	64·0	69·8	74·9	82·9	94·3
	Mean.	...	...	...	...	...	...	65·7	59·2	58·1	64·1	64·6	74·3	...	67·0	60·6	54·8	59·5	63·4	70·5	80·3
	Range.	...	...	...	...	...	...	20·0	20·9	24·3	26·1	25·9	28·3	...	19·7	19·7	18·3	20·7	22·9	24·8	28·0
Luxor (Roof).	Min.	[18] 55·3	49·4	44·2	47·8	55·2	60·9	...	48·4	47·4	49·1	55·2	...	...	...	49·9	45·5	49·2	[19] 54·4	...	...
	Max.	88·0	75·4	73·4	76·0	84·7	89·8	...	75·5	77·3	82·2	86·4	...	...	...	76·3	70·2	75·8	83·8	...	...
	Mean.	71·6	62·4	58·8	61·9	69·9	75·3	...	61·9	62·3	65·6	70·8	...	...	...	63·1	57·9	62·5	69·1	...	...
	Range.	32·7	26·0	29·2	28·2	29·5	28·9	...	27·1	29·9	33·1	31·2	...	...	...	26·4	24·7	26·6	29·4	...	...
[1] Luxor Desert W. or Luxor Fields.	Min.	...	...	50·1	[20] 52·5	[21] 61·3	...	...	50·3	49·9	[22] 56·8	...	...	...	...	...	35·9	37·5	[23] 44·5	...	...
	Max.	...	...	65·1	71·8	83·0	...	...	75·3	76·9	82·1	...	...	...	...	...	67·9	73·7	82·5	...	...
	Mean.	...	...	57·6	62·1	72·1	...	...	62·8	63·4	69·4	...	...	...	...	...	51·9	55·6	63·5	...	...
	Range.	...	...	15·0	19·3	21·7	...	...	25·0	27·0	25·3	...	...	...	...	...	32·0	36·2	38·0	...	...
Assouan.	Min.	...	54·0	[24] 49·4	51·1	[25] 54·2	...	[26] 55·3	51·7	53·0	56·2	61·0	...	...	[27] 58·5	54·0	48·6	52·1	60·7	...	...
	Max.	...	75·3	73·8	75·8	84·9	...	79·5	77·7	80·5	88·1	91·1	...	...	86·4	81·1	75·3	81·1	90·4	...	...
	Mean.	...	64·6	61·6	63·4	69·5	...	67·4	64·7	66·7	72·1	76·0	...	...	72·4	67·5	62·0	66·6	75·6	...	...
	Range.	...	21·3	24·4	24·7	30·7	...	24·2	26·0	27·5	31·9	30·1	...	...	27·9	27·1	26·7	29·0	29·7	...	...

[1] 1893-94. Valley of the Tombs of the Kings. 1894-95. Dec. 3, 1894, to Jan. 11, 1895, 300 yards in the Desert W. of Luxor. Jan. 12, 1895, to Feb. 11, 1895, 1½ miles in the Desert W. of Luxor. 1896. Luxor Fields. [2] 5th to 15th. [3] 10th to 30th. [4] 18th to 24th missing. [5] to 21st. [6] 13th to 30th. [7] 1st to 10th. [8] 7th to 28th. [9] 10th to 30th. [10] 18th to 31st. [11] 10th to 12th and 23rd to 25th missing (4 days). [12] 1st to 12th. [13] 20th to 30th. [14] 1st to 18th. [15] 10th to 30th. [16] 25th to 28th missing. [17] 1st to 11th. [18] 22nd to 30th. [19] to 22nd. [20] to 22nd. [21] 1-5 and 26-31 missing. [22] 16-24 missing. [23] March 1-3, 10 and 11, 17-23. [24] 22-29 missing. [25] to 22nd. [26] 25-30. [27] ? reliable.

TABLE II.—Mean Two-Hourly Temperatures, 1895 to 1896.

Hour.	Cairo.					Mena House.						Helouan.						Luxor (Roof).					Luxor Fields.				Assouan.				
	Dec.[1]	Jan.[2]	Feb.[3]	Mar.	Mean.	Dec.	Jan.	Feb.	Mar.	Apr.[4]	Mean (*a*)	Dec.	Jan.	Feb.	Mar.	Apr.	Mean (*a*)	Dec.	Jan.	Feb.	Mar.[5]	Mean.	Jan.	Feb.	Mar.[6]	Mean.	Dec.	Jan.	Feb.	Mar.	Mean.
2 A.M.	58·0°	49·0°	50·5°	55·0°	53·1°	55·0°	50·5°	52·0°	54·5°	59·5°	53·0°	54·5°	49·5°	53·5°	56·5°	63·0°	53·5°	55·5°	50·5°	55·0°	61·5°	55·6°	41·0°	43·0°	53·5°	45·8°	58·0°	52·5°	56·5°	66·0°	58·0°
4	57·5	47·5	49·0	53·5	51·9	53·5	48·5	50·5	53·0	57·5	51·4	52·5	48·0	51·5	55·0	60·5	51·7	52·5	48·5	52·0	59·0	53·0	39·0	41·0	53·0	44·3	56·0	50·5	54·0	63·0	55·9
6	56·0	46·5	48·5	51·5	50·6	52·5	47·0	49·5	51·5	56·5	50·1	52·0	47·0	50·5	53·0	59·0	50·6	51·0	47·0	50·5	57·0	51·0	37·5	39·5	54·5	43·8	54·5	49·0	52·5	62·0	54·0
8	55·5	47·0	50·5	54·5	51·9	53·5	48·0	51·5	56·0	63·0	52·2	55·0	49·5	52·0	58·0	65·0	53·6	56·5	50·5	57·5	65·0	57·4	42·0	49·0	70·0	53·7	60·0	54·5	59·0	70·0	60·9
10	62·0	53·0	59·5	63·5	59·5	60·0	55·0	59·5	65·0	70·5	59·9	62·5	56·0	60·5	66·5	73·5	61·4	66·0	59·5	66·5	73·5	66·4	56·0	62·5	76·5	65·0	70·0	64·5	70·0	80·5	71·2
Noon	69·0	59·0	66·0	70·5	66·1	66·0	60·5	65·5	70·0	76·5	65·5	67·5	61·0	66·0	71·5	79·0	66·5	71·5	65·5	71·5	79·5	72·0	63·0	69·5	83·5	72·0	77·0	71·5	77·0	86·5	78·0
2 P.M.	72·5	62·0	68·0	73·0	68·9	68·5	62·5	67·5	72·5	78·5	67·7	69·5	63·0	68·5	73·5	81·5	68·6	75·0	68·5	74·5	82·5	75·2	66·5	72·5	85·0	74·7	80·0	74·0	80·0	88·5	80·6
4	70·0	60·0	65·5	72·0	66·9	66·5	60·5	66·5	71·5	77·5	66·2	67·5	61·5	68·0	72·5	81·0	67·4	75·0	68·5	74·5	82·5	75·2	66·0	72·0	84·0	74·0	77·5	72·5	78·0	86·0	78·5
6	65·0	57·0	61·0	68·0	62·7	62·5	57·5	62·0	67·0	73·5	62·2	62·5	57·5	64·0	68·5	77·0	63·1	68·5	62·5	68·5	76·5	69·0	56·5	61·5	71·5	63·2	71·0	65·0	71·5	79·0	71·6
8	62·0	54·5	57·5	63·0	59·2	60·0	55·0	57·5	62·5	67·0	58·7	59·5	55·0	60·5	64·0	72·0	59·7	64·5	59·0	64·5	71·5	64·8	50·0	54·5	66·5	57·0	66·5	61·5	67·0	75·0	66·0
10	60·5	52·0	54·0	59·5	56·5	57·5	53·0	55·5	59·0	63·5	56·2	58·0	53·0	57·5	61·0	68·0	57·4	60·0	56·5	62·5	67·5	61·6	46·5	52·0	62·5	53·7	63·0	57·5	64·0	71·5	64·0
12	59·5	50·5	52·0	57·0	54·7	55·5	51·5	53·5	56·5	61·0	54·2	56·0	51·0	55·5	58·5	65·5	55·2	57·0	53·0	58·5	64·5	58·2	43·5	48·0	56·0	49·2	60·0	54·5	60·5	68·0	60·7
Mean	62·3	53·2	56·8	61·8	58·5	59·2	54·1	57·6	61·6	67·0	58·1	59·7	54·3	59·0	63·2	70·4	59·0	62·7	57·4	63·0	70·0	63·3	50·6	55·4	68·0	58·0	66·0	60·6	65·3	74·7	66·6

[1] December 1-9. [2] January 6-27. [3] February 3-29. [4] April 1-18. [5] March 1-23. [6] March 17-23. (*a*) Excluding April.

TABLE III.—Temperature. Mean of Four Months, 1895 to 1896.

Station.	Month.	Min.	Max.	Mean.	Range.
		°	°	°	°
Mena House .	December .	50·9	69·9	60·4	19·0
	January . .	45·6	63·6	54·6	18·0
	February . .	47·7	68·5	58·1	20·8
	March . .	50·5	73·8	62·1	23·3
	Mean . .	48·7	68·9	58·8	20·3
Helouan .	December .	50·8	70·5	60·6	19·7
	January . .	45·7	64·0	54·8	18·3
	February . .	49·1	69·8	59·5	20·7
	March . .	52·0	74·9	63·4	22·9
	Mean . .	49·4	69·8	59·6	20·4
Luxor (Roof)	December .	49·9	76·3	63·1	26·4
	January . .	45·5	70·2	57·9	24·7
	February . .	49·2	75·8	62·5	26·6
	March . .	54·4	83·8	69·1	29·4
	Mean . .	49·7	76·5	63·1	26·8
Assouan . .	December .	54·0	81·1	67·5	27·1
	January . .	48·6	75·3	62·0	26·7
	February . .	52·1	81·1	66·6	29·0
	March . .	60·7	90·4	75·6	29·7
	Mean . .	53·8	82·0	67·9	28·1

TABLE IV.—Temperature. Mean of Four Months for Two Years.

Station.	Month and Year.	Min.	Max.	Mean.	Range.
		°	°	°	°
Helouan .	December 1894	48·8	69·7	59·2	20·9
	,, 1895	50·8	70·5	60·6	19·7
	January 1895	46·0	70·3	58·1	24·3
	,, 1896	45·7	64·0	54·8	18·3
	February 1895	51·1	77·2	64·1	26·1
	,, 1896	49·1	69·8	59·5	20·7
	March 1895	51·7	77·6	64·6	25·9
	,, 1896	52·0	74·9	63·4	22·9
	Mean . .	49·4	71·7	60·5	22·3
Luxor (Roof)	December 1894	48·4	75·5	61·9	27·1
	,, 1895	49·9	76·3	63·1	26·4
	January 1895	47·4	77·3	62·3	29·9
	,, 1896	45·5	70·2	57·9	24·7
	February 1895	49·1	82·2	65·6	33·1
	,, 1896	49·2	75·8	62·5	26·6
	March 1895	55·2	86·4	70·8	31·2
	,, 1896	54·4	83·8	69·1	29·4
	Mean . .	49·9	78·4	64·1	28·5
Assouan . .	December 1894	51·7	77·7	64·7	26·0
	,, 1895	54·0	81·1	67·5	27·1
	January 1895	53·0	80·5	66·7	27·5
	,, 1896	48·6	75·3	62·0	26·7
	February 1895	56·2	88·1	72·1	31·9
	,, 1896	52·1	81·1	66·6	29·0
	March 1895	61·0	91·1	76·0	30·1
	,, 1896	60·7	90·4	75·6	29·7
	Mean . .	54·7	83·2	68·9	28·5

TABLE V.—Temperature. Mena House. January, February, March and April for Three Years; December for Two Years.

Month and Year.	Min.	Max.	Mean.	Range.
	°	°	°	°
December 1893 . . .	48·9	68·5	58·7	19·6
,, 1895 . . .	50·9	69·9	60·4	19·0
Mean . .	49·9	69·2	59·5	19·3
January 1894 . . .	45·7	65·2	55·4	19·5
,, 1895 . . .	47·6	71·4	59·5	23·8
,, 1896 . . .	45·6	63·6	54·6	18·0
Mean . .	46·3	66·7	56·5	20·4
February 1894 . . .	46·6	69·3	57·9	22·7
,, 1895 . . .	51·2	77·7	64·5	26·5
,, 1896 . . .	47·7	68·5	58·1	20·8
Mean . .	48·5	71·8	60·2	23·3
March 1894 . . .	48·2	72·1	60·1	23·9
,, 1895 . . .	51·2	75·4	63·3	24·2
,, 1896 . . .	50·5	73·8	62·1	23·3
Mean . .	50·0	73·8	61·8	23·8
April 1894 [1] . . .	53·4	77·4	65·4	24·0
,, 1895 . . .	57·0	84·5	70·8	27·5
,, 1896 [2] . . .	54·9	79·5	67·2	24·6
Mean . .	55·1	80·5	67·8	25·4
Mean of all .	50·0	72·4	61·2	22·4

[1] April 5-15. [2] April 1-18.

TABLE VI.—Temperature. Luxor Roof. Three Years.

Month and Year.	Min.	Max.	Mean.	Range.
	°	°	°	°
December 1893 . . .	49·4	75·4	62·4	26·0
,, 1894 . . .	48·4	75·5	61·9	27·1
,, 1895 . . .	49·9	76·3	63·1	26·4
Mean . .	49·2	75·7	62·4	26·5
January 1894 . . .	44·2	73·4	58·8	29·2
,, 1895 . . .	47·4	77·3	62·3	29·9
,, 1896 . . .	45·5	70·2	57·9	24·7
Mean . .	45·7	73·6	59·7	27·9
February 1894 . . .	47·8	76·0	61·9	28·2
,, 1895 . . .	49·1	82·2	65·6	33·1
,, 1896 . . .	49·2	75·8	62·5	26·6
Mean . .	48·7	78·0	63·3	29·3
March 1894 . . .	55·2	84·7	69·9	29·5
,, 1895 . . .	55·2	86·4	70·8	31·2
,, 1896 . . .	54·4	83·8	69·1	29·4
Mean . .	54·9	85·0	69·9	30·0
Mean of all .	49·6	78·1	63·8	28·4

TABLE VII.—Temperature. Assouan. December and February for Three Years; January and March for Two Years.

Month and Year.	Min.	Max.	Mean.	Range.
	°	°	°	°
December 1893 . . .	54·0	75·3	64·6	21·3
,, 1894 . . .	51·7	77·7	64·7	26·0
,, 1895 . . .	54·0	81·1	67·5	27·1
Mean . .	53·2	78·0	65·6	24·8
January 1895 . . .	53·0	80·5	66·7	27·5
,, 1896 . . .	48·6	75·3	62·0	26·7
Mean . .	50·8	77·9	64·3	27·1
February 1894 . . .	51·1	75·8	63·4	24·7
,, 1895 . . .	56·2	88·1	72·1	31·9
,, 1896 . . .	52·1	81·1	66·6	29·0
Mean . .	53·1	81·7	67·4	28·5
March 1895 . . .	61·0	91·1	76·0	30·1
,, 1896 . . .	60·7	90·4	75·6	29·7
Mean . .	60·8	90·7	75·8	29·9
Mean of all .	54·5	82·1	68·3	27·6

TABLE VIII.—Temperatures. Monthly Extremes and Range.

Station.	Year.	Extremes.		Range.	Daily Means.		Range.	Daily Range.	
		Min.	Max.		Highest.	Lowest.		Greatest.	Least.
	Dec.	°	°	°	°	°	°	°	°
Mena House.	1893	38	86	48	71	52	19	32	4
	1894	...	...	...	...	...	...	...	...
	1895	45	77	32	70	54	16	27	13
	Mean	41·5	81·5	40	70·5	53	17·5	29	8
Helouan.	1893	...	...	...	...	...	...	...	...
	1894	41	84	43	70	51	19	27	12
	1895	42	80	38	67	54	13	26	4
	Mean	41·5	82	40·5	69	53	16	26	8
Luxor.	1893	39	89	50	73	53	20	35	11
	1894	40	85	45	70	55	15	34	9
	1895	42	86	44	71	55	16	32	11
	Mean	40	86·6	46·6	71	54	17	34	10
Assouan.	1893	41	90	49	76	52	24	29	9
	1894	41	88	47	74	54	20	33	13
	1895	48	92	44	76	60	16	36	15
	Mean	43	90	47	75	55	20	33	12
	Jan.								
Mena House.	1894	39	79	40	69	51	18	26	8
	1895	37	82	45	69	50	19	36	13
	1896	37	74	37	64	48	16	24	4
	Mean	37·6	78	40·4	67	49	18	29	8
Helouan.	1894	...	...	...	...	...	...	...	...
	1895	37	81	44	67	50	17	34	12
	1896	39	72	33	65	50	15	27	10
	Mean	38	76·5	38·5	66	50	16	30	11
Luxor.	1894	38	86	48	70	54	16	43	19
	1895	37	89	52	72	53	19	37	10
	1896	38	82	44	67	53	14	33	9
	Mean	37·6	85·6	48	70	53	17	38	13
Assouan.	1894	41	88	47	72	53	19	35	10
	1895	44	89	45	74	59	15	39	8
	1896	43	91	48	73	56	17	35	7
	Mean	42·6	89	46·4	73	56	17	36	8

Station.	Year.	Extremes.		Range.	Daily Means.		Range.	Daily Range.	
		Min.	Max.		Highest.	Lowest.		Greatest.	Least.
	Feb.	°	°	°	°	°	°	°	°
Mena House.	1894	40	77	37	64	54	10	32	11
	1895	44	99	55	82	56	26	36	17
	1896	38	92	54	73	50	23	40	9
	Mean	40·6	89	48·4	73	53	20	36	12
Helouan.	1894	...	...	...	...	...	...	...	...
	1895	45	97	52	82	56	26	35	14
	1896	42	92	50	75	50	25	39	10
	Mean	43·5	94·5	51	78	53	25	37	12
Luxor.	1894	40	90	50	69	57	12	42	12
	1895	43	99	56	78	59	19	42	18
	1896	42	96	54	78	54	24	41	12
	Mean	41·6	95	53·4	75	57	18	42	14
Assouan.	1894	45	90	45	72	57	15	40	9
	1895	50	103	53	83	62	21	44	18
	1896	43	103	60	85	56	29	42	14
	Mean	46	99	53	80	58	22	42	14
	Mar.								
Mena House.	1894	42	92	50	70	51	19	41	15
	1895	43	91	48	77	55	22	38	8
	1896	45	88	43	73	56	17	33	13
	Mean	43·3	90·3	47	73	54	19	37	12
Helouan.	1894	...	...	...	...	...	...	...	...
	1895	44	92	48	76	55	21	39	12
	1896	47	87	40	70	59	11	34	11
	Mean	45·5	89·5	44	73	57	16	36	11·5
Luxor.	1894	42	104	62	84	55	29	44	13
	1895	45	102	57	87	61	26	47	12
	1896	48	(101)[1] 93	?45	89	63	26	40	16
	Mean	45	103	58	87	60	27	44	14
Assouan.	1894	43	109	66	86	57	29	46	14
	1895	53	108	55	92	66	26	47	9
	1896	54	105	51	93	68	25	42	16
	Mean	50	107	57	90	64	26	45	13

[1] 101 would be the interpolated figure missing, on the day of a high Temperature at Assouan.

TABLE IX.—Relative Humidity, 1893-1896.

Hour	1 Luxor Roof, 1893-94.					2 Luxor Desert W., 1893-94.				3 Assouan, 1893-94.				
	Dec.	Jan.	Feb.	Mar.	Mean.	Jan.	Feb.[1]	Mar.[2]	Mean.	Dec.	Jan.	Feb.	Mar.[3]	Mean.
	%	%	%	%	%	%	%	%	%	%	%	%	%	%
2 A.M.	71	73·5	64·5	53·5	65·6	52	45	33·5	43·5	53·5	56	50·5	40·5	50·1
4	72·5	81	65	57·5	69	57	47·5	37	47·2	70	65	55	50	60
6	74·5	86	68	63	72·9	61·5	51	39·5	50·6	73	70·5	57·5	55	64
8	66·5	77·5	65	54·5	65·9	62·5	52	41	51·8	68	73	59	46·5	61·6
10	50·5	58	47·5	38	48·5	58·5	44·5	34·5	45·8	54	55·5	46	31·5	46·7
Noon	42	46	38	29·5	38·9	49	36	25·5	36·8	43·5	42	37·5	20	35·7
2 P.M.	37	39·5	32·5	23·5	33·1	41·5	29·5	19·5	30·2	37·5	31·5	30	13	28
4	39·5	40·5	31·5	22·5	33·5	39	30·5	17·5	29	39	28	28	13·5	27·1
6	50·5	52	40·5	28·5	42·9	43·5	34·5	21	33	44·5	30·5	31	17	30·7
8	58	59	46·5	39	50·6	45·5	36·5	26	36	49·5	37	36	21	35·9
10	62	64	50·5	40·5	54·3	45·5	36·5	27·5	36·5	54	43	40	26·5	40·9
12	65·5	70·5	57	46	59·7	48·5	39	29·5	39	58·5	49	46	32·5	46·5
Mean	57·5	62·3	50·5	41·3	52·9	50·3	40	29·3	39·9	53·7	48·4	43	30·6	43·9

Hour	4 Helouan, 1894-95.					5 Luxor Roof, 1894-95.					6 Luxor Desert W., 1894-95.				
	Dec.	Jan.	Feb.	Mar.	Mean.	Dec.	Jan.	Feb.	Mar.	Mean.	Dec.[4]	Jan.	Feb.	Mar.[5]	Mean.
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
2 A.M.	74	63·5	64·5	68·5	67·6	67·5	71·5	74	47·5	65·1	71·5	56·5	46·5	31·5	51·5
4	76	65·5	67·5	73	70·5	71·5	76·5	77·5	51·5	69·2	75·5	64·5	50·5	35	56·4
6	77	66·5	69·5	74	71·7	73·5	78·5	74·5	55	70·4	80·5	70·5	55·5	39	61·4
8	68	65·5	66	62	65·4	66·5	70·5	68	49	63·5	77	66·5	58·5	41·5	60·9
10	59	50	49·5	45·5	51	49·5	54	58·5	35	49·2	56	51·5	48	35·5	47·7
Noon	50·5	39·5	38	37	41·2	38·5	41	40	21·5	35·2	42·5	38	37	24	35·4
2 P.M.	45	34	32·5	33	36·1	33	33·5	31	18	28·9	34·5	28	30·5	17·5	27·6
4	47·5	35	33·5	32·5	37·1	32·5	34	34	18	29·6	32	27·5	30	15·5	26·2
6	56·5	40·5	41	39·5	44·4	45	46	43·5	24·5	39·7	40	35	33·5	18·5	31·7
8	60	46·5	46	49	50·4	54·5	56	54	30	48·6	45	37·5	35	21·5	34·7
10	65	55	53·5	58	57·9	60·5	59	58·5	35	53·2	54	42·5	36	24	39·1
12	68	60	59	64	62·7	65·5	65·5	67·5	40·5	59·7	62·5	49·5	39·5	27·5	44·7
Mean	62·2	51·8	51·7	53	54·7	54·8	57·2	56·7	35·5	51	55·9	47·3	41·7	27·6	43·1

[1] Feb. 1-22 and 28. [2] Mar. 1-26. [3] Mar. 1-22. [4] Dec. 3-31. [5] Mar. 1-14.

Hour	7 Assouan, 1894-95.					8 Mena House. 1895-96.					9 Helouan, 1895-96.				
	Dec.[6]	Jan.	Feb.	Mar.[7]	Mean.	Dec.	Jan.	Feb.	Mar.	Mean.	Dec.	Jan.	Feb.	Mar.	Mean.
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
2 A.M.	56	54·5	41	35·5	46·7	83·5	80	86·5	85·5	83·9	69·5	70	70	69·5	69·7
4	59·5	61	46·5	40·5	51·9	87	86	85·5	87·5	86·5	72·5	72·5	73·5	73	72·9
6	62	65·5	51	46	56·1	89·5	91	87·5	91·5	89·9	73·5	75	70	76	73·5
8	59·5	60·5	50·5	44	53·6	88	90·5	86	86	87·6	70·5	67·5	68	68	68·5
10	38·5	43	36·5	31·5	37·4	75·5	72	61·5	60	67·2	60	54·5	50	47·5	53
Noon	30	31	23	20·5	26·1	57	54·5	42·5	42·5	49·1	46	46	39	35·5	41·5
2 P.M.	26	23·5	14	14·5	19·5	47·5	45·5	38	34·5	41·2	39·5	41	34	28·5	35·7
4	27	24·5	13·5	13	19·5	51·5	50·5	41	37	45	40·5	45·5	33·5	29·5	37·2
6	32	27·5	17	15·5	23	65	59·5	54	47	56·2	51·5	52·5	42·5	37·5	46
8	40	33·5	22·5	20	29	73	67	67·5	59·5	66·7	57	58	49·5	45·5	52·5
10	46·5	41·5	27·5	24	34·9	79	72	77·5	74·5	75·7	65	61	60	56·5	61·2
12	52·5	48	34·5	30	41·2	82	76	82	81	80·2	67	66·5	63·5	62·5	64·7
Mean	44·1	42·8	31·4	27·9	36·5	73·2	70·4	67·5	65·5	69·1	59·4	59·2	54·4	52·5	56·4

Hour	10 Luxor Roof, 1895-96.					11 Luxor Fields, 1895-96.				12 Assouan, 1895-96.				
	Dec.	Jan.	Feb.	Mar.[8]	Mean.	Jan.	Feb.	Mar.[9]	Mean.	Dec.[10]	Jan.	Feb.	Mar.[11]	Mean.
	%	%	%	%	%	%	%	%	%	%	%	%	%	%
2 A.M.	73·5	78·5	64·5	55	67·9	95	94·5	87	92·2	60·5	56·5	50·5	42	52·4
4	77	83	73·5	59	73·1	98	96·5	91	95·2	66	61·5	57·5	47·5	58·1
6	78	84·5	76	66	76·1	98	96	95·5	96·5	70·5	67	62·5	52·5	63·1
8	65·5	78·5	63·5	56·5	66	96	85·5	79	86·8	65·5	64	61	47·5	59·5
10	48	58·5	45·5	39·5	47·9	66·5	55·5	48	56·6	47·5	48·5	46·5	34·5	44·2
Noon	36·5	44·5	34	29	36	53	44	38	45	37	35·5	34	24	32·6
2 P.M.	29	36·5	29·5	22	29·2	46·5	41·5	29·5	39·2	28	28·5	25·5	17·5	24·9
4	29·5	34·5	30	21	28·7	49·5	45·5	29·5	42·8	25·5	26·5	23	17·5	23·1
6	43·5	49	40	27·5	40	72·5	65·5	42·5	60·2	32	31·5	27	21	27·9
8	55·5	60·5	50	36·5	50·5	84	77·5	61·5	74	38·5	38·5	33·5	27	34·4
10	61	68·5	51·5	41·5	55·5	90·5	76	65	77·2	46	45·5	38	32	40·4
12	67·5	75	58	47	62	92·5	85	74·5	84	52	51·5	43·5	36·5	45·9
Mean	55·4	62·6	51·3	41·7	52·7	78·5	71·9	61·7	70·8	47·4	46·2	41·9	33·3	42·2

[6] Dec. 17-31. [7] Mar. 1-25. [8] Mar. 1-23. [9] Mar 1-22. [10] Dec. 9-31 [11] Mar. 1-30.

TABLE X.—Temperature and Relative Humidity. April and November.

Hour.	Temperature.				Relative Humidity.			
	November.		April.		November.		April.	
	Helouan 1895.	Assouan 1896.	Mena Ho. 1897.	Helouan 1897.	Helouan 1895.	Assouan 1896.	Mena Ho. 1897.	Helouan 1897.
2 A.M.	61	66	59	61·3	75	51	84	66
4	59·5	63	58	58·6	78	57	86	70·5
6	58·5	61	57	57·6	79	62	86	71
8	63·5	69·5	65	66	72	57	67	55·5
10	69	79·5	73·5	74	61	43	42	34
Noon.	74	87	79·5	79·6	42	22	27	25
2 P.M.	76	88·5	82·5	81·8	42	22	21	19·5
4	74	84	81	80·6	46	24	21	19·5
6	69	78	76·5	76·8	55	28	29	24
8	66	74	69·5	71	64	33	48	37
10	64	70	64·5	66·6	71	39	64	50·5
12	62	68	61	63	73	44	76	61
Mean	66·4	74	69	69·7	63·1	40·1	54·2	44·4

TABLE XI.—Comparison of the Fahrenheit and Centigrade Thermometer Scales.[1]

Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.
°	°	°	°	°	°	°	°
0	−17·8	30	−1·1	60	+15·6	90	+32·2
1	17·2	31	−0·6	61	16·1	91	32·8
2	16·7	32	0·0	62	16·7	92	33·3
3	16·1	33	+0·6	63	17·2	93	33·9
4	15·6	34	1·1	64	17·8	94	34·4
5	15·0	35	1·7	65	18·3	95	35·0
6	14·4	36	2·2	66	18·9	96	35·6
7	13·9	37	2·8	67	19·4	97	36·1
8	13·3	38	3·3	68	20·0	98	36·7
9	12·8	39	3·9	69	20·6	99	37·2
10	12·2	40	4·4	70	21·1	100	37·8
11	11·7	41	5·0	71	21·7	101	38·3
12	11·1	42	5·6	72	22·2	102	38·9
13	10·6	43	6·1	73	22·8	103	39·4
14	10·0	44	6·7	74	23·3	104	40·0
15	9·4	45	7·2	75	23·9	105	40·6
16	8·9	46	7·8	76	24·4	106	41·1
17	8·3	47	8·3	77	25·0	107	41·7
18	7·8	48	8·9	78	25·6	108	42·2
19	7·2	49	9·4	79	26·1	109	42·8
20	6·7	50	10·0	80	26·7	110	43·3
21	6·1	51	10·6	81	27·2	111	43·9
22	5·6	52	11·1	82	27·8	112	44·4
23	5·0	53	11·7	83	28·3	113	45·0
24	4·4	54	12·2	84	28·9	114	45·6
25	3·9	55	12·8	85	29·4	115	46·1
26	3·3	56	13·3	86	30·0	116	46·7
27	2·8	57	13·9	87	30·6	117	47·2
28	2·2	58	14·4	88	31·1	118	47·8
29	−1·7	59	+15·0	89	+31·7	119	+48·3

[1] "Hints to Meteorological Observers." W. Marriott, F.R.Met.Soc.

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THE WINTER CLIMATE

OF

THE EGYPTIAN HEALTH RESORTS

AND ITS INFLUENCE ON DISEASE

(Read before the XIIth International Congress of Medicine, Moscow, August 1897)

THE WINTER CLIMATE OF THE EGYPTIAN HEALTH RESORTS AND ITS INFLUENCE ON DISEASE.

It has been pointed out by the author, in a paper read before the Royal Meteorological Society of England, that there are great differences in the local conditions of the Egyptian climate, and that these local conditions are for the most part modifications of the Libyan desert climate produced by varying amounts of cultivation and varying distances from the Mediterranean Sea. These modifications may appear locally, in the absence of any wind, in the midst of cultivated land; or they may be brought by the wind to a point in the desert from a large or small area of cultivation situated in the line of the prevailing wind. The results of six sets of instruments, recording day and night automatically under various conditions in different parts of Egypt, has made it possible to define very accurately the extent of the different influences at work, and placed beyond discussion the importance of the influence exercised by cultivation. Over thirty years ago, when Dr. Dalrymple wrote his excellent impressions of Egypt, it had perhaps never occurred to him that there might be a difference between living in the midst of the Nile cultivated valley and living on its western side in the desert, but this was a conclusion which could only be established by comparative methods, and Dr. Dalrymple had not at his disposal over fifty thousand two-hourly readings of temperature and humidity. However, Dr. Dalrymple lived in the period when the long list of distinguished medical visitors had established without figures the superiority of the climate of Upper Egypt to that of Lower Egypt, and to this fact he drew attention. For many years past, invalids have been sent to Egypt to sail in a dahabeah, or to pass the time in Cairo, or at one of the health resorts in Upper Egypt, which have sprung up at one or other of the world famous antiquarian sights, and looking back one cannot but say that it was the best that could be done at the time. Now wider knowledge and recent observations are modifying these opinions and must effect great changes. Medical influence and opinion, the one guide that has brought to light the importance of dryness of air with purity from organisms, conditions existing on high snow mountains, over the desert, and, to some extent, at sea, is the determining factor in peopling the snow-covered Alps in mid-winter and the inhospitable desert with invalids. Each case is sent with a definite purpose, to attain a definite object, to effect a definite physiological or pathological change. In proportion to the accuracy of the physician's conception of the work to be done, of the time required

and available, of the means to be followed, and the patient's endeavours to carry out the plan prescribed, so will the result to the patient be more or less advantageous. "Go to Egypt"—the Egypt of the Foreign Office —is, as a final prescription, unsatisfactory. In a country where the patient may be exposed to heavy dew throughout night after night at one spot, and at another spot may never be within 20° or 30° of the dew-point; where at one place there may be the dust and impurity of the countless myraids of germs of a crowded city, and at another, air so pure that scientists have questioned whether it contains any single living organism; where the night temperature of two spots, a mile or two apart, may vary night after night as much as 15° to 20°; where the prevailing wind may bring air over scores of miles of cultivated land, or on the other hand over hundreds of miles of desert; it is essential that, where such wide differences exist, we should be far more precise. If we expect the maximum of advantage, we must take the maximum of available means to compass our object, and the means in the case of Egypt are manifold.

The two great factors which have always been prominent in the winter climate of Egypt are the warmth and dryness of the air, and lately great attention and importance has been attached to a third, the purity of the air from organisms, it is to the first two points that this research will mainly refer.

The original research on the winter climate of Egypt, upon which this paper is based, has been the work of the past three or four winters carried on at the four health resorts of Egypt, Mena House, and Helouan in Lower Egypt, Luxor and Assouan in Upper Egypt. In addition, various subsidiary stations in the desert, the hills of the Nile Valley, and in the cultivated land, were also selected to ascertain the influence of the Nile and of cultivation on the desert air proper.

The instruments were automatic recording thermometers and hygrometers, writing day and night, all properly compared and adjusted to work in unison one station with another, in order to obtain a true comparative picture of the variations in the climate in different parts of Egypt.

I am indebted to Mr. W. Longmore, M.R.C.S., L.R.C.P. (London), Dr. Arthur J. M. Bentley, the late Mr. Jalland, M.B., Mr. J. L. Hichens, Mons. F. Douat, and also to Dr. Page May for kindly helping in taking the records. The series of records is a very large one, permitting of readings both of temperature and humidity at any hour of the day or night; the whole available data have been discussed fully in their meteorological bearing in a paper on the "Winter Climate of Egypt" by the author, read before the Royal Meteorological Society, on 16th December 1896. We shall now discuss the bearing of some of the more important points from the medical standpoint.

Temperature.[1]

The temperatures, it must be remembered throughout, are taken on the roofs of buildings for the sake of uniformity, in the interior of a Stevenson's screen, and though to be regarded as shade temperatures, yet they are probably 6° to 9°$\frac{3}{5}$(during the hours of sunshine) above

[1] The Fahrenheit Scale is employed throughout this paper; a table of comparison of the Fahrenheit and Centigrade scales will be found on p. 49.

readings taken under the shadow of a northern verandah, or 5° above readings taken in the broken shade of a garden (Table G., *Meteor. Rep.*). The minima during the hours of the night would be about 4° or 5° higher than in a dryish garden.

The following table gives the mean monthly minima and maxima, the mean temperature and range during the three winters, 1893-4, 1894-5, 1895-6, at the four health resorts. The month of November at Assouan is for the year 1896:—

TABLE I. Table of Temperatures.

			Minimum.				Maximum.				Mean.				Range.			
Month.	District of Egypt.	Station.	1893-4	1894-5	1895-6	Mean.	1893-4	1894-5	1895-6	Mean.	1893-4	1894-5	1895-6	Mean.	1893-4	1894-5	1895-6	Mean.
Nov.	Lower	Mena .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
		Helouan	...	...	57·2	...	...	...	76·9	...	...	...	67·0	...	...	...	19·7	...
	Upper	Luxor .	...	...	57·6	...	...	...	83·8	...	...	...	70·7	...	...	...	26·2	...
		Assouan	...	...	62·3	...	...	...	94·7	...	...	...	78·5	...	...	...	32·4	...
Dec.	Lower	Mena .	48·9	...	50·9	49·9	68·5	...	69·9	69·2	58·7	...	60·4	59·5	19·6	...	19·0	19·3
		Helouan	...	48·8	50·8	49·8	...	69·7	70·5	70·1	...	59·2	60·6	59·9	...	20·9	19·7	20·3
	Upper	Luxor .	49·4	48·4	49·9	49·2	75·4	75·5	76·3	75·7	62·4	61·9	63·1	62·4	26·0	27·1	26·4	26·5
		Assouan	54·0	51·7	54·0	53·2	75·3	77·7	81·1	78·0	64·6	64·7	67·5	65·6	21·3	26·0	27·1	24·8
Jan.	Lower	Mena .	45·7	47·6	45·6	46·3	65·2	71·4	63·6	66·7	55·4	59·5	54·6	56·5	19·5	23·8	18·0	20·4
		Helouan	...	46·0	45·7	45·8	...	70·3	64·0	67·1	...	58·1	54·8	56·4	...	24·3	18·3	21·3
	Upper	Luxor .	44·2	47·4	45·5	45·7	73·4	77·3	70·2	73·6	58·8	62·3	57·9	59·7	29·2	29·9	24·7	27·9
		Assouan	...	53·0	48·6	50·8	...	80·5	75·3	77·9	...	66·7	62·0	64·3	...	27·5	26·7	27·1
Feb.	Lower	Mena .	46·6	51·2	47·7	48·5	69·3	77·7	68·5	71·8	57·9	64·5	58·1	60·2	22·7	26·5	20·8	23·3
		Helouan	...	51·1	49·1	50·1	...	77·2	69·8	73·5	...	64·1	59·5	61·8	...	26·1	20·7	23·4
	Upper	Luxor .	47·8	49·1	49·2	48·7	76·0	82·2	75·8	78·0	61·9	65·6	62·5	63·3	28·2	33·1	26·6	29·3
		Assouan	51·1	56·2	52·1	53·1	75·8	88·1	81·1	81·7	63·4	72·1	66·6	67·4	24·7	31·9	29·0	28·5
Mar.	Lower	Mena .	48·2	51·2	50·5	50·0	72·1	75·4	73·8	73·8	60·1	63·3	62·1	61·8	23·9	24·2	23·3	23·8
		Helouan	...	51·7	52·0	51·8	...	77·6	74·9	76·2	...	64·6	63·4	64·0	...	25·9	22·9	24·4
	Upper	Luxor .	55·2	55·2	54·4	54·9	84·7	86·4	83·8	85·0	69·9	70·8	69·1	69·9	29·5	31·2	29·4	30·0
		Assouan	...	61·0	60·7	60·8	...	91·1	90·4	90·7	...	76·0	75·6	75·8	...	30·1	29·7	29·9
Apr.	Lower	Mena .	53·4	57·0	54·9	55·1	77·4	84·5	79·5	80·5	65·4	70·8	67·2	67·8	24·0	27·5	24·6	25·4
		Helouan	...	...	58·1	58·4	...	...	82·9	82·0	...	...	70·5	70·2	...	...	24·8	23·5
		1897	...	...	58·8		...	...	81·0		...	...	69·9		...	...	22·2	
	Upper	Luxor .	60·9	...	...	...	89·8	...	...	...	75·4	...	...	...	28·9	...	...	...
		Assouan	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

The mean temperatures for the four winter months (December to March) were—

	Min.	Max.	Mean.
Mena House	48·7	70·4	59·5
Helouan	49·4	71·7	60·5
Luxor	49·6	78·1	63·8
Assouan	54·5	82·1	68·3

The months of November and April are only complete for certain years.

For the four months, December to March, the maximum temperature was, on the average of three years, 1·3° warmer at Helouan than at Mena House, 6·4° warmer at Luxor than at Helouan, and 4° warmer at Assouan than at Luxor. The minimum temperature was at Helouan ·7° warmer than at Mena House, ·2° warmer at Luxor than at Helouan, and 4·9°

warmer at Assouan than at Luxor. In order to estimate the values medically of these temperatures, one must not be misled by the effect such temperatures would have in a humid climate. The dryness of the Egyptian climate makes high temperatures not only pleasant but beneficial in most cases, and absolutely essential in certain diseases, as will be seen later. In order to estimate the value of these temperatures a curve has been constructed from the two-hourly readings of the thermometer and hygrometer showing the degree of heat that is desirable and the relative humidity actually occurring on the same days. This desirable Egyptian day is perhaps unusual, it is the average of a number of days noted at Luxor on the recording instruments at the time as of exceptional excellence; the temperature was very agreeable, the relative humidity was low, and generally a light breeze from the north. The maximum temperature was 85°, the minimum 52°. The relative humidity varied between 18 and 65 per cent in the 24 hours. The extension of the warmth and dryness of these days late into the afternoon and evening is a feature to be noted, and is typical of desert influence. The more nearly the temperature chart of a station in Egypt approximates to this curve the more desirable is such a station as a health resort. The conditions on such days may be summed up as rather marked warmth with excessive dryness. It will be observed that for the most part the winter months at all the stations err on the side of being rather too cold by day, and certainly by night, in the monthly mean. During November and March, however, at Luxor and Assouan in Upper Egypt, and during April at Helouan and Mena House in Lower Egypt, the temperature closely coincides with the ideal. In both Upper and Lower Egypt the temperature of November very nearly resembles that of March, with the exception of being more uniform in its progress from day to day. After January the temperature in Lower Egypt corresponds nearly to that of the previous month in Upper Egypt, so that the harvest is fully a month or more later in Lower Egypt.

The daily variation or range of temperature is 5° or 6° greater in Upper than in Lower Egypt, and increases from December to April. The greater variation is produced by the greater dryness of the air in Upper Egypt not allowing the formation of cloudiness, and therefore allowing greater warming by day and a greater cooling by night. In the desert the range is less, the absence of cultivation allowing greater heating of the surface by day, and also assisting in maintaining a high minimum temperature by night.

The range of temperature in Egypt is controlled largely by the diathermancy of the air, and this again is controlled by the relative humidity. In the cold period of the year, therefore, the access of temperature is slow; at stations situated in or near the cultivated land, such as Luxor and Mena House, it is delayed in the morning, often being 2 hours later than at such stations as Assouan and Helouan. At Assouan in Upper Egypt, more directly under the influence of the desert than the stations of Lower Egypt, the access of temperature to the maximum is earlier, and the fall to the minimum is more gradual than is the case in Lower Egypt.

Effect of Cultivation on the Temperature.

Simultaneous tracings were taken for a long period in the cultivated land above the growing corn, half a mile south of Luxor Hotel; the results

were remarkable and of great importance in demonstrating the influence of cultivation on the temperature, and the necessity for adopting the site on the roofs of buildings for a comparative view of the conditions present at different stations. A careful study of the figures will bring one to the conclusion, that unless the influence of cultivation be carefully calculated, the figures will be misleading in any comparative set of temperatures. If we take the readings of a dahabeah, one night tied up to a sand-bank, the following night under a vertical edge of cultivated land, the difference in the night temperatures will be very wide, and unless note is taken of the surroundings the readings will be of little or no value. The effect of cultivation on the temperature is to produce a rapid fall just before sunset, and for the following two or three hours to maintain this fall, and to attain a far lower minimum than that reached at stations only slightly influenced by cultivation, so that a difference of 15° to 20° may be found at stations a mile or two apart at 6 a.m. The cooling of the air is strictly limited to the area of cultivation on still nights, but if there be a breeze from the direction of a cultivated area the lowering effect on the temperature will be carried into the neighbouring desert. If the prevailing wind be from the desert across the cultivated area the warmer air of the desert at night will invade the cultivated area. The prevailing wind at both Mena House and Helouan passes over the cultivated Delta, the prevailing wind at Luxor and Assouan passes over the desert. Cultivation reduces the temperature from noon to 4 p.m. slightly only (2·5°), but after sunset there is a cooling in the cultivated area four times as extensive as that in the desert, and lasting till 6 a.m. The access of temperature from sunrise to 10 a.m. in the cultivated area is far slower than on the roofs of buildings in the towns or on the edge of the desert. After the gathering of the crops the course of the temperature is entirely different, then the uncultivated fields are warmer by day than the roofs in towns, from sunset till 6 p.m. there is the same difference as existed before the harvest, after 6 p.m. the difference is only half of that existing before the harvest, at 6 a.m. only one third. At 8 a.m. the fields instead of being 8° cooler are actually 3° warmer; in other words, the cultivated area after the harvest very closely resembles, in its climate, desert conditions. The period therefore after the first week of March in Upper Egypt, when the harvest is gathered, is of considerable value to the invalid at a health resort influenced at all by cultivation. The corresponding period in Lower Egypt would not commence till about the middle or end of April. Cultivation, therefore, depresses the whole night temperature up to 10 a.m. to so great an extent that the daily variation is one quarter more than at places only partly influenced by cultivation, and twice that at stations hardly influenced by cultivation. A cultivated area in Upper Egypt reaches the freezing-point 17 times in the month of January and February, when a spot half a mile distant on the roof of an hotel only reached 38° on one occasion. The question of the relative extent of the influence of cultivation at the four health resorts will be considered under relative humidity.

Influence of the Desert on the Temperature.

The climate of the desert, and by the desert we mean the Libyan or Western Desert across which the prevailing wind reaches the Upper

Nile, is the one important factor to the invalid. It is the climate for which he has been sent out, and of which he usually obtains so little. It is difficult to imagine any air more invigorating and life-giving than that of the desert proper. There is a dryness and elasticity in it, and a sense of renovation when breathing it unlike anything else. The course of the temperature in the desert is uniform and much less subject to the more or less sudden variations, which mark that of stations in or under the influence of cultivated land. These sudden variations are less frequent at Helouan and Assouan than at Luxor and Mena House. Comparing the temperature in the Valley of the Tombs of the Kings and on Luxor Hotel roof (Table I. *Meteor. Rep.*), we note that in the desert the minimum temperature is 4° higher. The maximum is about the same in both places, and the range is 4° less in this part of the desert. In January the desert was colder than Luxor, and in March rather warmer in the maximum. The curve of the temperature in the desert is a gradual one, except at sunrise, when the absence of mist makes the upstroke decided and sharp.

Influence of Altitude on the Temperature.

Tracings taken at a point 300 feet above the Nile Valley under the influence of the Libyan Desert afforded remarkable results (Table H. *Meteor. Rep.*). The mean minimum was actually 9° higher than on the roof of Luxor Hotel situated 3 miles off, the maximum 7° lower, the daily range being less than half that of Luxor roof for the same time. Altitude thus affords great advantages both as regards the minima by night and the maxima by day, at least for the warmer part of the winter months in the south of Egypt. The station at Luxor, and that at Assouan (to a less extent), are under the influence of the lower strata of air, which over the cultivated land and, to a less extent over the river, are colder than the air of the desert at night at a certain altitude.

We have seen the enormous results produced by strictly local conditions on the temperature, so localised as to present differences between the temperature of the road and that of the field through which it passes at a level of 6 or 8 feet higher. It is therefore of importance to consider the immediate surroundings in which a patient lives, owing to the stillness of the nights. On the other hand, there are large general conditions affecting the climate of the health resorts broadly, both in temperature and relative humidity, conditions which are the result, in Lower Egypt, of the prevailing wind at the health resorts passing over the Delta, whereas in Upper Egypt, where the cultivation is so limited (almost nil. at Assouan), the result of the prevailing wind (N.W.) passing over a very large part of the Libyan Desert. On the many nights when there is little or no wind this larger general condition is not sufficient to overcome the effect produced by even the limited extent of cultivation existing at a given point.

Sunrise and Sunset.

Much has been written erroneously on the fall of temperature at sunset, and it has frequently been stated to be very great. In the desert it practically does not exist, or it cannot be observed in the tracing. At

Helouan and Assouan it is hardly to be found, though at Mena House and Luxor it is frequently traceable to the extent of 3° to 5° in a quarter of an hour; 1° to 2° fall occasionally occurs at Helouan. The fall of 3° to 5° at Luxor may happen once a week by cold air being blown in from cultivated areas. At Assouan a fall of 2° to 3° would be exceptional. In the cultivated area it is true there is a greater fall from 4 to 6 p.m., but not limited to the hour of sunset. The error has arisen by mistaking the sensation produced by the withdrawing of the sun's rays from the surface of the body for an actual and large fall in the air temperature, which, however, does not exist. The sensation of "chill" is long delayed after sunset. At sunrise the temperature is marked by a sudden sharp rise from the minimum at most places, especially distinct at Assouan, in the desert, and in the cultivation, in the last case owing to the greatly depressed minimum.

Humidity.

The feature of the Egyptian climate which has always attracted most attention is the dryness of the air, and this has been the more noticeable in Upper Egypt, where the rainfall is hardly measurable. If we consider the relative humidity, there is no known health resort which can even approach the climate of Upper Egypt in dryness; we find that Assouan is one-third drier than the mean of the two health resorts near Cairo, drier still than Biskra and Tenerife, and far drier than Algiers, and considerably drier than the high altitudes of Colorado.

Relative Humidity.

This in Egypt is a factor largely dependent upon local conditions and on the course of the temperature. The comparative results here given are like those of the temperature taken from tracings on the roofs of hotels to avoid as much as possible the immediate disturbing effect of any cultivation. They are the averages of 12 readings in the 24 hours. The relative humidity from December to March at Luxor (three years) was 52·2 per cent, and at Assouan 40·9; at Helouan (two years) the relative humidity was 55·5, and at Mena House (one year) 69·1. During

TABLE II.—Relative Humidity for Four Months (December to March) during the Hours of the Day.

Hour.	Mena House.	Helouan.	Luxor.	Assouan.
10 A.M.	67·2	53	47·9	44·2
Noon.	49·1	41·5	36	32·6
2 P.M.	41·2	35·7	29·2	24·9
4 ,,	45	37·2	28·7	23·1
6 ,,	56·2	46	40	27·9
Mean.	51·7	42·7	36·3	30·5

the month of November the relative humidity at Assouan was 40; at Helouan 63. During the month of April the relative humidity at Mena House was 54·2; at Helouan 44·5. During the winter months, therefore,

Assouan is 11·3 per cent drier than Luxor, 14·6 per cent drier than Helouan, and 28·2 per cent drier than Mena House. Luxor was 3·3 per cent drier than Helouan, and Helouan 13·6 per cent drier than Mena House. If, however, we take the readings from 10 a.m. to 6 p.m. (that part of the day during which the invalid is generally in the open air), the result is as shown in the following table, constructed from Table IX. of the *Meteorological Report*:—

The Effect of Cultivation on the Relative Humidity.

Cultivation and growing crops (Table N. *Meteor. Rep.*) have the effect of rapidly increasing the relative humidity before midnight, especially from shortly before sunset to 6 p.m. and also up to 8 p.m., so that the dew-point is rapidly reached, and at 2 a.m. the relative humidity is over 90 per cent. During the day (10 to 6), the relative humidity was 13·7 per cent greater in the cultivated fields than on Luxor roof or in the neighbouring desert; but during the night the relative humidity in the cultivated fields was 21·4 per cent higher than Luxor roof, and about 40 per cent higher than the neighbouring western desert. The growing crops protect the soil from the sun's rays during the day, and the limited amount of heat absorbed is rapidly lost soon after sunset by both radiation and evaporation, thus inducing a low temperature and high relative humidity equally rapidly.

The Effect of the Desert on the Relative Humidity.

The effect of the desert (Table Q. and Fig. 3, *Meteor. Rep.*) is mainly seen in the course of the relative humidity at night. During the day the condition is much the same (Fig. 3) in the desert as in the cultivated land or in the villages, but after sunset and till 8 a.m., the absence of cultivation allows a much lower relative humidity in the desert than at those stations which are either in the cultivated land or under its influence. The type of a desert climate, and the test of the influence of desert on a given station, is in the amount of the increase of relative humidity before midnight; the less the amount added before midnight the greater the influence exhibited by the desert. The course of the relative humidity at the health stations compared with the effects produced by cultivation on the relative humidity shows that Mena House and Helouan are both under the influence of cultivated land (the Delta), the latter to a much less extent, however, than the former, and chiefly by means of the wind. In Upper Egypt the stations at Assouan and Luxor are both influenced slightly by cultivation, though to a far less extent at Assouan than at Luxor. The influence of cultivation at Luxor is almost direct, and is abolished by the wind (Fig. 5, *Meteor. Rep.*). The influence corresponding to cultivation (which does not exist at Assouan) is that of the river itself, and is probably limited to a very small area at Assouan; that of the river frontage of the town itself, and is felt during the night and early morning only, and is terminated by the rising of the wind.

If we attempted to give in comparative figures the influence either of cultivation or of river on the relative humidity at these stations, taking the western desert at Luxor as a standard, and measuring the influence

of cultivation by the amount added to the relative humidity before midnight, we find that Mena House is $\frac{28}{60}$ or about half, Helouan and Luxor $\frac{25}{60}$ or over one-third, Assouan $\frac{10}{60}$ or one-sixth under the influence of cultivation (v. pp. 34-37, *Meteor. Rep.*).

The Effect of Altitude on the Relative Humidity.

Tracings taken 300 feet above the plain, half a mile within the desert, showed that there is very little increase of relative humidity before midnight (Table Q. *Meteor. Rep.*), and it is probable that a similar condition exists at a certain height over the cultivated plain. The mists gathering over the cultivated plain at night extend only to the lower strata of air as a rule, commencing a few inches above the crop after sunset, reaching a greater height later in the evening, but generally not extending high enough to affect the air above 150 feet.

Effect of Wind on the Relative Humidity.

The effect of wind is dependent upon the area over which it has travelled, coming over hundreds of miles of desert, especially during the night when the difference in relative humidity between the desert and cultivation is so large, it will tend to abolish this difference, and there will be a fall in relative humidity (Fig. 5, *Meteor. Rep.*). If, as in Lower Egypt, it comes prevailingly across the Delta, then it will increase the relative humidity at Mena House and Helouan. At Assouan from 8 to 10 a.m. the rising wind of the day will blow as a rule up the line of the river, and so we find the relative humidity not diminishing rapidly until after the course up the river is cleared.

Absolute Humidity.

The absolute humidity for the four winter months in grains per 10 cubic feet of air was at Mena House 35, Luxor 31, Helouan 30, Assouan 28. Thus, in absolute humidity, Assouan is the driest station, being as low as 25 in January. At certain stations in the desert the absolute humidity descends as low as 19 or 20 grains.

The Drying Effects of the Climate.

The drying effects of the climate, both on the skin and on the lungs, are the important features in the treatment of disease.

The low relative humidity in Egypt permits a large amount of moisture to be taken up rapidly from the skin, so rapidly that perspiration is seldom visible except after marked exertion; at such times it is taken up so rapidly from the body that the body is liable to be chilled if precautions be not taken. The hair of the body is often dry and brittle from the same cause.

The low absolute humidity, especially of the desert stations of Upper Egypt and of the desert itself, renders the climate of great value in its drying effects on the lungs. The air inspired being charged with only a small amount of moisture is able to take up when raised to the body

temperature in the lungs a very large amount of moisture. These drying effects are represented in the following tables constructed from data for the winter months of 1895-96, and represent the averages of the figures of each two hours by day and night :—

TABLE III.—Drying Power of the Air at the Temperature of the Air (in Grains per Ten Cubic Feet of Air).

Month.	Mena House.	Helouan.	Luxor.	Assouan.
November	...	26	...	59 (1896)
December	16	25	29	36
January	14	19	18	30
February	15	26	31	39
March	20	30	47	63
April	...	...	...	...
Mean (four months)	16	25	31	42

From this table, and from Figs. B and D, we see the superiority in drying effect on the skin of the air of Upper Egypt, especially Assouan, over that of Lower Egypt, in all cases where a high action of the skin is imperative, especially in cases of Bright's disease, albuminuria, gouty conditions, etc., as will be considered later.

The drying effect of the air when raised in the lungs to the temperature of the body is seen at the various stations in the following table :—

TABLE IV.—Drying Power of the Air at the Temperature of the Body (in Grains per Ten Cubic Feet of Air Inspired).

Month.	Mena House.	Helouan.	Luxor.	Assouan.
November	...	146	...	154 (1896)
December	150	157	155	156
January	157	162	156	162
February	153	160	157	161
March	150	156	157	159
April	152 (1897)	...	...	...
Mean (four months)	152·5	158·7	156·2	159·5

If we divide these figures into the day (8 a.m. to 6 p.m.) and night (6 p.m. to 8 a.m.) we obtain the following results :—

TABLE V.—Drying Effect of the Air at the Temperature of the Air.

Month.	Mena House.		Helouan.		Luxor.		Assouan.	
	Day.	Night.	Day.	Night.	Day.	Night.	Day.	Night.
November	...	...	40	16	...	...	79	40
December	24	9	32	15	46	16	56	26
January	20	8	26	14	32	11	46	22
February	29	8	37	16	47	20	58	30
March	37	10	45	20	70	32	88	46
April	67	16	73	53	...	...	...	...
Mean (four months)	27·5	8·7	35	16·2	48·7	19·7	62	31

TABLE VI.—Drying Power of the Air at the Temperature of the Body.

Month.	Mena House.		Helouan.		Luxor.		Assouan.	
	Day.	Night.	Day.	Night.	Day.	Night.	Day.	Night.
November .	...	...	146	145	...	...	154	156
December .	150	149	156	156	159	154	157	158
January . .	153	157	162	162	159	156	162	164
February . .	157	153	162	158	160	157	160	164
March . .	154	149	160	156	160	157	161	161
April . .	159	145	164	153	...	...	...	...
Mean . (four months.)	155	152	160	158	159·5	156	160	162

From Table IV. we see that the drying power of the air on the lungs is greatest at Assouan, and least at Mena House, Helouan and Luxor being intermediate.

From Tables III. and V. we see that the drying effect of the air on the skin is one-third more at Assouan than at Luxor, and nearly twice as great at Assouan as at Helouan.

From Table VI. we find that the drying power of the air on the lungs for the months December to March is during the day the same at Helouan as at Assouan, but during the night it is greatly in favour of Assouan. At night Helouan is more favourable in this respect than Luxor, and Mena House is less favourable by both day and night than the other stations. During November at Assouan there is marked absolute dryness of the air compared with Helouan, amounting to 10 grains per 10 cubic feet. The air at Mena House and Helouan in November is much drier than that of Cairo. It is important to note this, because the contrary is sometimes stated. No further reference will be made to Cairo, as it is not suited in any way for invalids, and in November and December is actually prejudicial in many cases.

In considering the drying effects of the air on the lungs, we must remember that whilst the air of Falmouth for the same months will at the body temperature take up the same amount of moisture per cubic foot of air, yet the possibilities of breathing it constantly are far less than those afforded by the climate of Egypt; the relative humidity is so high that little moisture can be taken up from the skin, and this, combined with the low temperature of the air, throws upon the kidneys and lungs the work of getting rid of a far greater quantity of water than is the case in Egypt. If we consider the Engadine in winter, it has been pointed out by Dr. T. Wise that the air there is drier at the body temperature than that of Egypt. Dr. Wise's comparisons were, however, with the data of the observatory close to Cairo, and Cairo is no longer considered an Egyptian health resort. The comparison should have been made with Assouan or Helouan, which are 6 or 7 grains drier per 10 cubic feet of air than Cairo. It is, however, the case that the Engadine climate in winter is able to take up some 15 or 16 grains per 10 cubic feet of air more than that of Assouan, the driest of the Egyptian stations at present existing, though stations are possible in Egypt where the air closely approaches that of the Engadine even in absolute dryness. The advantages Egypt has, however, over the Engadine are: (1) only a slight

variation in the climate from one day to another; (2) no rain or snow, which so frequently interferes with outdoor exercise in the Engadine; (3) the air is as bracing as the Engadine, and yet warm with almost unbroken sunshine; (4) during the hours recommended it is possible to sit out far longer than in the Engadine; (5) the very low relative humidity of Egypt, as compared with the Engadine, is also a great factor in its favour; and (6) a further advantage is the absence of any difficulty in the case of Egypt for the months of March and April and half of May, which prove so trying to those in or from the Engadine.

Wind.

Wind is an important factor in the consideration of a station. If the land in the track of the prevailing wind at a given resort is dry desert and of great extent, then that resort is favourably situated. At Helouan and Mena House the prevailing wind over the Delta brings in the effects of cultivation to a certain extent. The almost equally prevalent wind in the winter months near Cairo is that from the South-west; this wind is often very cold in the latter half of December, through January, and the first half of February, but otherwise is a favourable and dry wind. At Luxor, situated in the midst of a six-mile width of cultivated land, the wind, which is usually North-west or West, is very favourable in its direction over large tracts of desert, but is lacking in constancy, so that during the latter part of November, and throughout December, and occasionally at other times, there is not enough wind. Assouan, where little or no wind is needed (except for the excellent sailing afforded in the cataract), there being practically no cultivation, is often subject to more wind than is pleasant, though the direction (North or North-west) is favourable. The South-west or South hot winds ("Khamseen") which blow at intervals throughout Egypt, though unpleasant on account of the dust, are not prejudicial, and might even be considered beneficial. They appear twice or three times between the end of February and the end of April, and may last one or two days on each occasion.

Sunshine is almost constant in Upper Egypt; at Assouan it is rarely broken. Sun records in Egypt are being made a subject of investigation by Dr. Page May.

Influence of the Climate of Egypt on Disease.

Though the beneficial effect medically of the climate of Egypt has been long known, it is only of late years that it is beginning to be more clearly understood and appreciated. In ancient days, the advice of the Roman physicians was to go to Egypt,[1] intending by "Egypt" "Alexandria," the great difficulties of travelling debarring further progress. The length of time occupied in sailing from Italy to Alexandria was considered a point in favour of Egypt.[2] Herodotus tells us the Egyptians are the healthiest people in the world next to the Libyans, and this he attributed to the constancy of the climate from day to day, and the apparent absence of so-called "seasonable" changes. It is interesting to note the health-giving properties he attributed to the Libyan Desert climate over that of Egypt.

[1] Strabo, xvii. 1, 7.

[2] Pliny, *Nat. Hist.* xxxi. 62.

Up to quite recent years, the only apparent advance on the Roman medical opinion consisted in the preference given to Cairo over Alexandria, and this was probably retrograde. Cairo, however, rapidly became only a stepping-stone to the health resorts near Cairo. Then followed the sailing up the Nile in dahabeahs, which revealed the excellent climate of Luxor. Within the last three years or so Assouan has rightly obtained a very high reputation as a step in advance, being a very material approach to the true Libyan Desert conditions, the climate of the Libyan and Nubian deserts appearing to be the final goal.

There still remains, however, the necessity of constructing sanatoria at suitable spots in Upper Egypt, where the position, aspect, altitude, construction, ventilation, warming and cooling of the air as may be required, and a constant supply of desert air to sleeping rooms have all been made questions of special study. Too much weight cannot be laid upon the necessity of a thorough ventilating system adapted to the climate, and producing a condition of climate in the sanatoria and bedrooms similar to that to which the invalid is exposed in the hours of the day recommended for outdoor life, affording thus an unbroken and even condition of climate and fresh air for the whole 24 hours.

It is hoped that the Railways of Egypt will provide carriages ventilated and free from dust, being supplied with filtered air, which would be a great boon to invalids.

Morbid Conditions or Diseases beneficially influenced by the Climate of Egypt.[1]

We cannot do better than here repeat the three classes of cases which, in the experience of Dr. Bentley of Mena House, Mr. Longmore of Luxor, Dr. Sandwith of Cairo, and the author, derive respectively *great benefit* and *some benefit* from, or are *unsuitable* for, the climate of Egypt.[2]

Class I.—Deriving Great Benefit.

Phthisis.—(1) Non-erethic cases; (2) hæmorrhagic cases; (3) non-acute cases of first or second stage, especially commencing deposit without very acute symptoms; (4) chronic quiescent phthisis; (5) cases associated with bronchitis. The best station in these cases is Assouan, or possibly Helouan, though Lower Egypt is too cold in December and January.

Asthma.—Idiopathic and symptomatic. The idiopathic will do well at any of the health resorts. If, however, it is associated with bronchitis, Assouan will be preferable. Those cases associated with dyspepsia would do well at Mena House, and those of distinctly nervous origin perhaps at Luxor or at either of the resorts.

Chronic Bronchitis and Emphysema will do best at Assouan, and at Helouan or Mena House in April.

Convalescent Cases from Pneumonia, Pleuro-Pneumonia, and Pleurisy from any Cause.—The best station is Assouan, or possibly Helouan.

[1] *Lancet*, October 27, 1894.

[2] In the selection of the suitable resorts for each set of cases, the opinion expressed is that of the author only.

Chronic Nasal and Pharyngeal Catarrah at any of the resorts.

Mental Strain and Break-down from over-work, any of the stations, or on the Nile steamers, or a dahabeah. In this special class of cases, if associated with gout, arterio-sclerosis, fibroid kidney, atheroma, and age, they would do better at Assouan, and later on, when the baths at Helouan are completed, would sometimes be benefited by a course of baths there. It is of special importance in these cases, whether associated with previous hemiplegic attacks or not, that they should be under medical advice as soon as they reach Egypt.

Insomnia.—The cases dependent upon heart-disease will not be specially benefited, the remaining cases will depend upon their pathology. If a warm temperature and dry air would be of special use Assouan would be the station, if a less stimulating air Luxor and Mena House. At Helouan and Mena House it must be remembered that there is no barking of dogs or noise at night.

Bright's Disease.—Bright's disease in all its forms and albuminuria. Beyond question Assouan is the best station, being the only resort which can attain near enough to a warm climate at night and warm enough by day to get the best results. The great relative dryness of the air and high temperature are specially needed in these cases, as is also the avoidance of the sudden changes of temperature and humidity noted at resorts influenced by cultivation.

Rheumatoid Arthritis, Gout, and Associated Lithiasis.—These are cases deriving great benefit, and would do well with a course of baths at Helouan before proceeding to Assouan.

Imperfect Convalescence from Acute Specifics,—scarlet fever, influenza, typhoid, diphtheritic paralysis, especially where the kidneys have been involved,—would be greatly benefited at all the resorts, especially in Upper Egypt.

Dyspepsia, Hepatic and Lithæmic, and Rheumatic Fever.—The dyspepsia dependent upon gout would be benefited by a course of baths at Helouan; they should then proceed to Upper Egypt.

Sciatica is also greatly benefited.

Class II. Deriving Some Benefit.

Dyspepsia.—Chronic atonic and chronic catarrhal would do well at any of the resorts, but at present perhaps better at Mena House or Luxor.

Hysteria, Hypochondriasis, Neurasthenia.—The first two classes would do well at Assouan, the latter equally well at Luxor or Mena House. These cases would also do well on the Nile steamers.

Early cases of locomotor ataxy or cerebro-spinal sclerosis do well on dahabeahs, or at any of the resorts affording passing interest and change of ideas with open-air life.

Neuralgia, Rheumatic, Gouty, or Malarial at Assouan or Helouan would derive benefit.

Early **valvular and "functional" heart-disease** would do best on a dahabeah or at Luxor or Mena House, provided they were not tempted to over-exercise, the avoidance of fresh rheumatic attacks being of great value.

Premature Senility, throughout Egypt, derives much benefit (Hermann Weber).

Bronchiectasis would do best at Assouan; children with strumous tendency, or predisposed to phthisis or with adenoid growths, at Assouan; and later (in the month of April) at Helouan or Mena House.

Hepatic Disease contracted in India, returning home too early in the winter (Sandwith).

Malaria, best by train to Assouan or Helouan; these cases should stay at the desert resorts.

Glycosuria and Eczema, in gouty subjects, would follow the course pursued by other cases with gout as a basis.

Laryngitis and "Clergyman's Sore Throat" (Mena House, Helouan, or Assouan; or if any of these places are found too windy, Luxor).

Cystitis, with pressure backwards, leading to commencing kidney disease (Assouan).

Chronic Ovaritis, Parametritis or Perimetritis, and Anæmia (Helouan or Assouan).

Class III.—Unsuitable Cases.

Phthisis with very acute symptoms or tendency to diarrhœa or repeated pleurisy, or involved larynx, or active disease of both lungs; Advanced emphysema, with weak dilated right side of the heart; Fatty heart; Angina pectoris; Hypertrophy and dilatation of the left side of the heart; Aortic regurgitation and aneurism; Advanced endocarditis; Dysentery or After-dysentery; Chronic diarrhœa; Tuberculous kidney.

General Remarks.

With regard to the cases of **hæmorrhagic phthisis** the opinion used to be held that they should not come to Egypt. Out of the numerous cases with such a history that one has seen in six winters in Egypt, both on the river and staying in hotels in Upper Egypt, hæmorrhage only occurred twice, and both cases would have been inadmissible in the first instance, being cases of acute phthisis. The author has seen five or six medical men winter in Egypt for this condition still active and well after six years.

It will be observed that the cases deriving the greatest benefit from the climate of Egypt are mostly diseases unknown or rare in Egypt, Phthisis, Asthma, Bronchitis, Gout (and its attendant disease of the arterial, renal, and cardiac organs), Bright's Disease, Insomnia, Rheumatoid Arthritis, Dyspepsia and Sciatica. In all these cases the relief to be obtained is very great in Egypt, and at the same time they are cases for which little or nothing can be done in Europe, with the exception of Phthisis, which has possible alternative resorts. For many of the cases quoted the climate is practically unique.

Period advisable at each Station.

The length of stay to be recommended in Egypt is from **November 1st to the end of April, or the middle of May.** The periods to be recommended at the health resorts of Egypt are as follows :—

1. **Helouan** and **Mena House,** the whole season.
2. **Luxor,** from December 1st to the end of March or early in April.
3. **Assouan,** from the middle of November to the end of March.
4. **Ramleh** (near **Alexandria**), the first half of May.
5. Those invalids ascending the Nile in **dahabeahs** should start in the middle of November, and preferably at, or south of, **Assiout,** to avoid the colder and damper northern reaches of the river, spending as much time as possible between **Assouan** and **Luxor** or between the two cataracts.

Invalids wishing to see Cairo can do so from Helouan or Mena House at the end of the season, and should on no account stay in Cairo in November or December. Invalids returning from Upper Egypt should stay during the month of April at Helouan or Mena House, as well as in that portion of November before ascending the Nile.

Sanitary Arrangements.

The sanitary arrangements at Assouan, Mena House, and Helouan are excellent. The earth system is in force at all the resorts except Helouan, which, however, has an excellent water system.

English physicians of long experience reside at the health resorts. The physicians are always ready to help by their advice those desiring to go to Egypt, and should be consulted if possible in England.

English nurses are also resident at all stations.

The Length of the Invalid Day.

At the different resorts the length of day available for the invalid is very different, and is limited by changes in the temperature and relative humidity, and varies with the respective months. The following table is suggested as a guide, and though not applying to all cases, is important to many, especially to those in whose cases a fall in temperature or a low temperature, and an increase in the relative humidity, would be prejudicial. It will be seen from Table VII. that the number of hours of the day during which the relative humidity is below 45 per cent in December and January is so limited in Lower Egypt, being none at Mena House, and only three hours a day at Helouan, that during these months the invalid must be satisfied in Lower Egypt with a higher relative humidity. If we take 50 per cent as a standard we see that Mena House has 1 and 3 hours respectively in these months, and Helouan 5 hours each month. The day lasting till 4 p.m. begins late, not before 11 a.m. It is important for invalids and their doctors to realise that it is far better to come out of the house late in the day and to stay out late than it is to come out early and go in at the proverbial sunset. The danger of sunset in Egypt is a delusion, it is exactly parallel to the danger of moderate exercise in the sun at noon and cooling down

in the shade of a building; the building represents the obstructing earth at sunset, there is no other difference. Any one accustomed to the climate of Egypt, after exercise comes into the shade of a building and puts on a cloak to cool down in, instead of taking anything off as in Europe; the same plan is to be followed in Egypt at sunset. The difficulty, if any, is, however, in the morning before the hours appearing in the 45 per cent

TABLE VII.—The Daily Time available at various Degrees of Dryness at Four Stations.

Station.	Month.	Relative Humidity.					Mean Temp. with Relative Humidity.	
		Below 35%.	Below 45%.		Below 50%.		Below 45%.	Below 50%.
		Hrs.	Time.	Hrs.	Time.	Hrs.		
Mena House.	November	...	...	...	...	...	...	...
	December	...	...	...	1–2	1	...	68·0
	January	...	...	...	1–4	3	...	61·0
	February	...	11–4	5	11–4	5	65·0	65·0
	March	1	11–4	5	11–6	7	70·0	70·0
	April	7	9–6	9	9–8	11	75·0	75·0
	Mean of 4 months	¼	...	2·5	...	4	67·5	66·0
Helouan	November	...	11–4	5	11–4	5	73·5	73·5
	December	...	1–4	3	11–4	5	69·0	67·5
	January	...	1–4	3	11–4	5	62·5	60·5
	February	3	11–6	7	9–8	11	65·7	62·0
	March	5	11–8	9	9–8	11	68·5	67·0
	April	9	9–8	11	9–10	13	75·0	74·2
	Mean of 4 months	2	...	5·5	...	8	66·4	64·2
Luxor	December	3	11–6	7	9–6	9	71·7	68·0
	January	1	11–4	5	11–6	7	65·5	65·5
	February	5	10–6	8	9–8	11	70·5	68·2
	March	7	9–10	13	9–Mt.	15	75·0	73·5
	Mean of 4 months	4	...	8·2	...	10·5	70·7	68·8
Assouan.	November	9	9–Mt.	15	9-Mt.	15	78·0	78·0
	December	5	11–8	9	9-10p.m	13	73·0	71·5
	January	4	11–10	11	9-10p.m	13	65·7	65·7
	February	9	11–Mt.	13	9-Mt.	15	70·0	70·0
	March	12	9-2 a.m.	17	7-4 a.m.	21	77·0	75·5
	Mean of 4 months	7·5	...	12·5	...	15·5	71·4	70·7

column of relative humidity for the respective months. It is then that chills are often felt and the air is cool in the shade. One cannot insist too strongly on attention to these details if the invalid is to arrive at the best result. The lower the relative humidity the more necessary to follow precautions to prevent chill, and the longer the number of hours during which an invalid is exposed to a low relative humidity the better for him. The time specially to be on one's guard is that at which the change takes place from a low relative humidity to a high, or *vice versâ*. During the same months (December and January) in Upper Egypt the hours are far

longer, 45 per cent being reached at Luxor for 7 and 5 hours respectively, and at Assouan for 9 and 11 hours, or twice as long at Luxor and three times at Assouan, that of Helouan. During February and March the hours below 45 per cent are 5 at Mena and 8 at Helouan, 10·5 at Luxor and 15 at Assouan. The mean number of hours per month (December to March) when the relative humidity is below 45 per cent is 2·5 at Mena, 5·5 at Helouan, 8·2 at Luxor, and 12·5 at Assouan; practically the whole day is available at Assouan, and in certain months much of the night. The number of hours per day when the relative humidity is below 35 per cent is on the average $\frac{1}{4}$ at Mena, 2 at Helouan, 4 at Luxor, and 7·5 at Assouan.

The mean temperature the patient will be exposed to during the hours with the relative humidity at 45 per cent and 50 per cent is also shown in the table; in the former case it is 66·4 at Helouan, 70·7 at Luxor, and 71·4 at Assouan. As will be seen from the temperature tables (*Meteor. Rep.*) during the month of March, the temperature at Assouan for the two hours from 1 to 3 p.m. rises to about 88° in the mean; if this were constant from day to day it would be about the most desirable temperature that could be enjoyed at Assouan, affording for the remainder of the day and the whole night the most perfect conditions. On half the days of that month, however, the temperature will be above this, and then from the hour of lunch to 3.30 p.m. the patient remains in a cool room in a building. At Assouan it will be noted that the invalid's day at 45 per cent relative humidity, as at the other resorts, does not begin early, but it goes on very late, far into the night, whereas it is closed early at Luxor and at Helouan. The present method adopted by invalids of changing about from sunshine to shade at 9 a.m. in light clothing, or shivering in a cold breakfast-room, at an hour when there are enormous changes in the temperature and relative humidity, is absolutely wrong, and must be avoided by the invalid until the time comes when in suitable sanatoria the properly ventilated invalid emerges into the open desert air at the time when it has reached the state of temperature and relative humidity desirable.

Dangers and Precautions.

The only dangers invalids are exposed to in Egypt are: (1) chill; (2) being improperly advised as to times, stations, and seasons by their friends or other people; (3) want of perseverance in details and rules.

(1) *Chill.*—The very excellence of the climate is itself the difficulty in this respect. The dryness of the air enables it to take up from the body surface enormous quantities of moisture rapidly, and this is especially felt by the individual after exercise and when exposed to a current of air. A strain is thereby thrown on the heat-regulating mechanism far greater than it has previously been accustomed to accommodate for, the result usually being a violent catarrhal attack, generally of the intestine, accompanied with fever and diarrhœa, which may sometimes prove serious if there is any neglect. Under medical treatment, however, the patient, as a rule, may expect to be cured in a few days usually. Early advice and careful attention to rules laid down will avoid several days' trouble, or a recurrence of that trouble. The careful patient following advice will avoid being attacked at all, and to this end he may with

advantage change the amount of his clothing three times a day. He should come out in the morning rather heavily clad until 11 a.m., lessening the amount of clothing at that hour, or such hour as he is advised; at sunset he will add a cloak, and he will clothe himself again more warmly for the evening at the dinner hour. A flannel band or tightly-fitting underclothing over the abdomen is advisable. In most cases, and especially in chest disease, a light short golf cloak is a very serviceable article of clothing. After exercise all persons in Egypt should cool down slowly by standing out of the wind, but in the sun.

(2) The second danger to which the patient is exposed, that of ignorance of the climatic conditions and their bearing on his own case, suggests its own remedy. The patient can hardly expect to be able himself to determine that precise condition of temperature and of relative humidity, of necessary precaution on numerous points of detail, which will influence considerably the amount of benefit he will derive. There is a best time to arrive and to depart from the station which is best suited for his case; there is a best means of travelling to and from the station selected; there is a best mode of daily life suited to his case; there is a best treatment he should undergo. If the patient is competent to decide all these questions for himself, he will do so, and derive the greatest benefit; but if he is not he will do well to consult those who are, without delay. It is probable that there are few people better able to afford the advice and knowledge required by the patient than the able physicians residing at the different health resorts of Egypt.

(3) The third difficulty must be, for the most part, met by the patient himself.

We have previously referred to the inadvisability of staying in Cairo in November and December especially, on account of the possibility of slight feverish attacks, which never occur at the health resorts, but occasionally attack patients in Cairo at this time.

Intervening Stations and Routes.

The route out from England by "long sea," starting in the middle of October, is to be recommended. Patients wishing to avoid the long sea route at this time of the year may come *viâ* Marseilles by P. and O., and landing at Alexandria or Ismailia proceed direct to their health station, passing through Cairo to Helouan or Mena House. Those going to Assouan in the middle of November and to Luxor at the beginning of December may pass the interval at Helouan or Mena House. The invalid going to Assouan or Luxor in November or the beginning of December may, if he wishes, go by the excellent Nile steamers. English doctors travel on board all the larger steamers, and may be consulted if necessary. Later in the season the weather becomes cold on the Nile, and certain invalids will do well to go by train, which will reach Luxor in about 13 hours and Assouan in about 18. The return journey down the Nile to Mena House or Helouan at the end of March is quite possible by steamer, if the patient follows certain precautions; but for the rest of the season it is too cold for certain invalids, the wind being very piercing, and if these invalids cannot stay

till the close of the season they will do well to return northwards by train. Often, after leaving Egypt, invalids desire to visit other countries on the homeward journey, and it is necessary to remind them that, if they are tempted to leave Egypt much before the time recommended, they will make two errors. Firstly, they will cut short the month of April at the health resorts of Northern Egypt (Mena House and Helouan), and it must be remembered that this month in Northern Egypt is the best for invalids that the winter affords, just as March is the best month in Southern Egypt. Secondly, they will arrive in the south of Europe before the best weather is available. Some of the stations that are available and beneficial in the south of Europe may be arranged in the following order—Athens, Corfu, Taormina, Capri, Amalfi, Beyrout (Syria), and the Riviera. Several physicians in Athens prefer the Isle of Poros to Athens itself as a health resort. The accommodation at Athens is very good, and it is important that much of the day should be spent on the seashore, which is very beautiful, and easily reached from Athens.

The best month at all these stations is from the third week of April to third week of May. To arrive at Taormina, Capri, or Amalfi before the period mentioned would on the average be inadvisable. Comparing the climatic conditions offered by Egypt with those of Southern Europe at this period, we should regard the end of the third week in April as the earliest time to leave Egypt, though, as we have above stated, the end of April is better. The homeward journey to England by sea, if postponed till the beginning of May from Egypt or Naples, is the most desirable route; and at this season the weather is far more reliable and pleasant than can be expected earlier.

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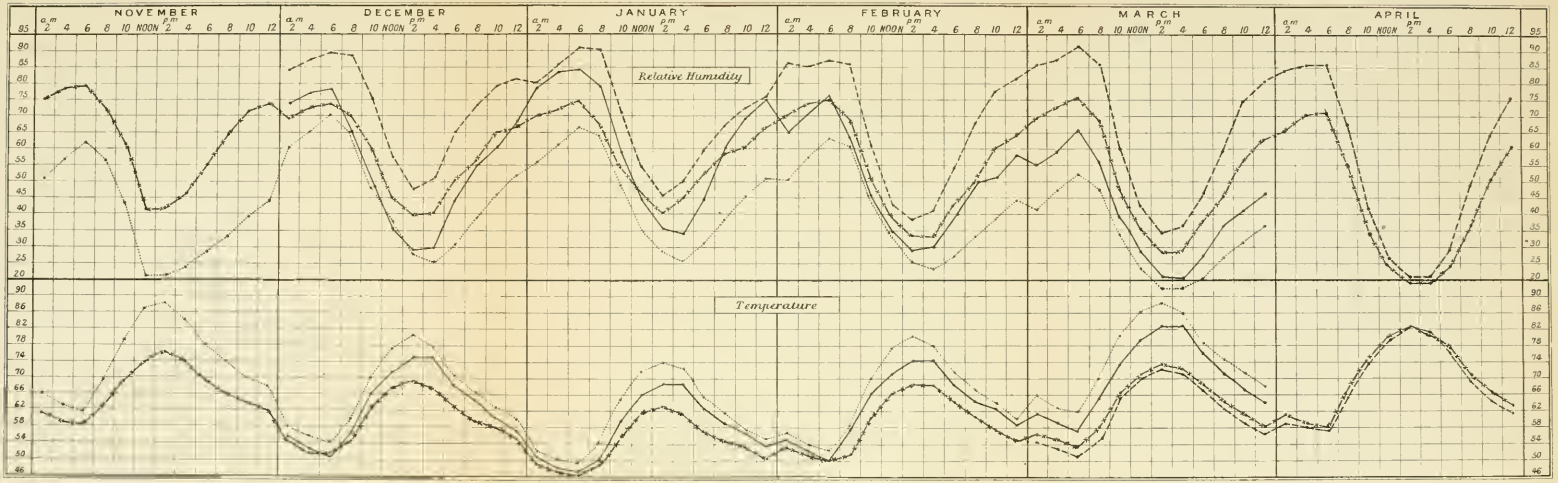
FIG. A. TEMPERATURE & RELATIVE HUMIDITY AT HELOUAN, MENA HOUSE, LUXOR & ASSOUAN.

Nov 1895 to April 1896.



Mena House
Helouan
Luxor
Assouan

April is for the Year 1897

Nov is for the Year 1896

Fig. B – Drying Power of the Air at the Temperature of the Air (1895-96)

(The drying power is represented in grains per 10 cub feet of air.)

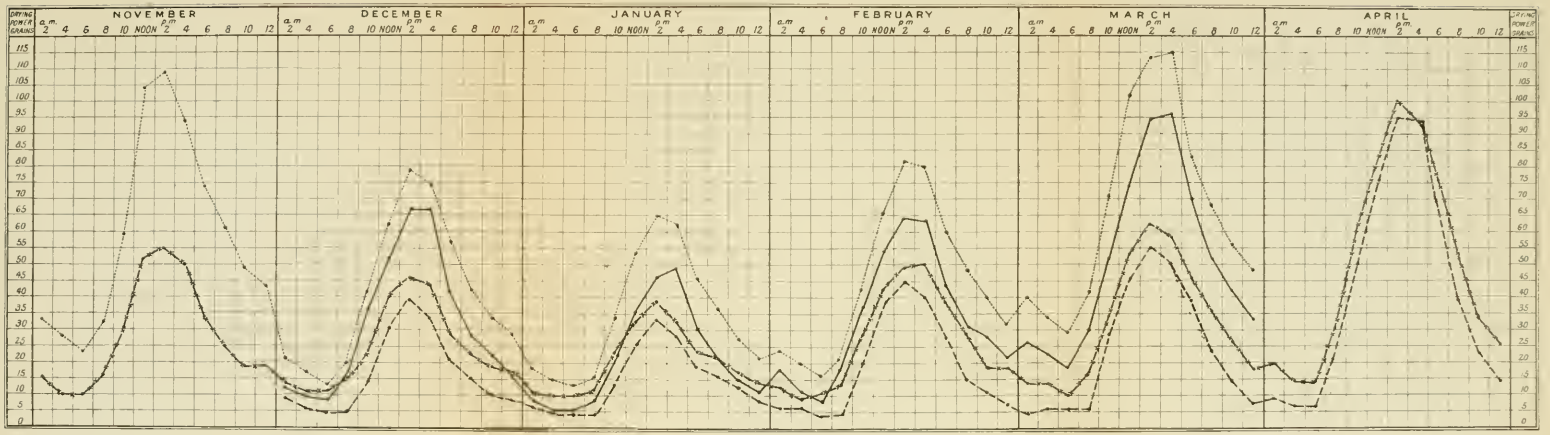


Fig. C. – Drying Power of the Air at the Temperature of the Body (1895-96)

(The drying power is represented in grains per 10 cub feet of air.)

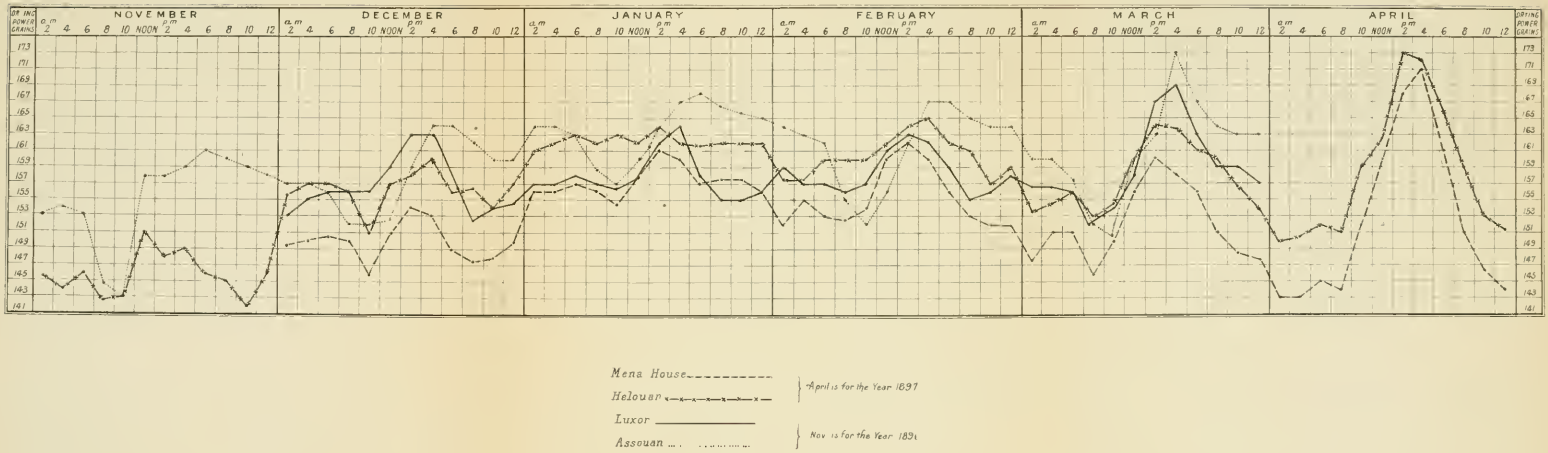
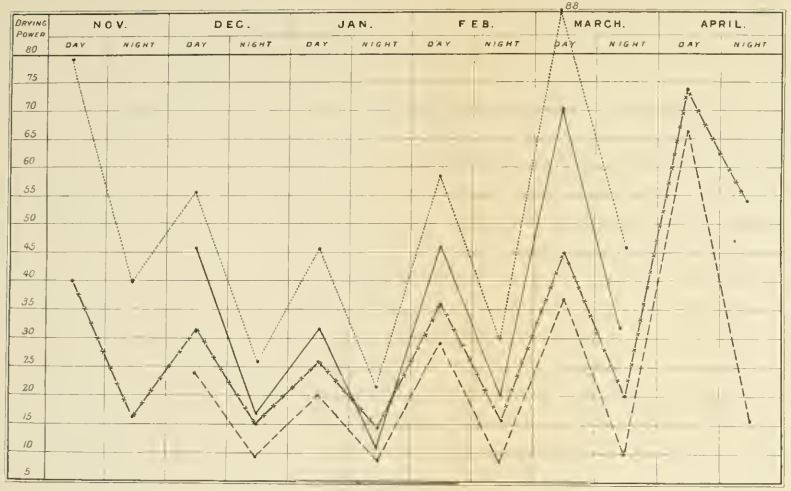


Fig. D. Drying Power of the Air at the Temperature of the Air.

Day 8 a.m. to 6 p.m.
Night 8 p.m. to 6 a.m. } Means of 2-hourly readings

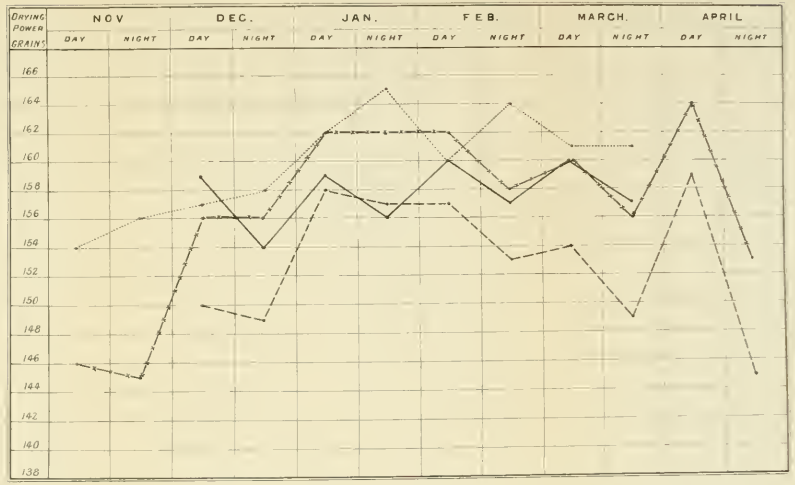


(The Drying Power is represented in Grains per 10 Cubic feet of Air.)

Mena House
Helouan
Luxor
Assouan

Fig. E. Drying Power of the Air at the Temperature of the Body.

Day 8 a.m. to 6 p.m.
Night 8 p.m. to 6 a.m. } Means of 2-hourly readings



(The Drying Power is represented in Grains per 10 Cubic feet of Air)

Mena House
Helouan
Luxor
Assouan